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THESIS

THE MANPOWER, PERSONNEL, AND TRAINING ANALYSIS SUBSPECIALIST: AN ANALYSIS OF HISTORICAL DATA

by

Jane Denise Boyer

December 1985

Thesis Advisor: Paul R. Milch

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The Manpower, Personnel, and Training Analysis Subspecialist: An Analysis of Historical Data

by

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Lieutenant, United States Navy
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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

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December 1985

ABSTRACT

This thesis presents an overview of the fledgling MPTA subspecialty and its subspecialists. Even though analysis of historical data dominates this research, the recently approved MPTA specialist track is addressed and its impact within the subspecialty community briefly discussed. Topical issues such as availability and utilization of subspecialists, utilization tour completion, and inventory vs. requirements for certain primary officer specialties are addressed. A Markov model is introduced as a method to predict the distribution of URL MPTA subspecialists in operational/leadership, utilization, and nonutilization type billets. The graduate education steady state quota model is used to show the potential impact of the specialist on total MPTA subspecialist inventories and NPS student inputs.

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I. INTRODUCTION

The current Manpower, Personnel, and Training Analysis (MPTA) subspecialty was conceptualized in the late 1970's in response to the Navy's need for subspecialists with decision making and analytical skills in the manpower arena. In order to meet the Navy's need to educate officers as manpower analysts, the Manpower/Personnel Management curriculum at the Naval Postgraduate School (NPS) became more analytical and was renamed the Manpower/Personnel Analysis curriculum.

The NPS program is designed to provide an officer with the necessary educational skill requirements (ESR's) to function as a manpower analyst. In addition, a Master's of Science in Management degree is awarded upon successful completion of all academic requirements. The Navy graduates receive a xx33P officer subspecialty code which signifies that the officer has acquired an additional skill as a MPTA subspecialist and also possesses an applicable Master's degree. Other officers can be designated as MPTA subspecialists and receive the xx33P code after completion of a Master's degree which meets the requisite ESR's at a civilian university. These officers are called lateral entrants to the MPTA subspecialty.

This thesis presents an overview of the fledgling MPTA subspecialty and its subspecialists. Even though analysis of historical data dominates this research, the recently approved MPTA specialist track is addressed and its impact within the subspecialty community briefly discussed.

Chapter II begins with an explanation of the officer subspecialty system, followed by the history of the curriculum. The remainder of the chapter is devoted to analysis of historical data. Topical issues such as availability and utilization of subspecialists, utilization tour completion, and inventory vs. requirements for certain primary officer specialties are addressed. The historical data was obtained from the officer master file of the Defense Manpower Data Center, Monterey.

In Chapter III, a Markov model is introduced as a method for predicting the distribution of URL MPTA subspecialists in operational/leadership, utilization, and nonutilization type billets. Although there is insufficient data available at this time for a more thorough model validation process, the methodology is presented as a foundation for future work.

The MPTA 1100 (GURL) specialist is the topic of Chapter IV. Projected inventories of GURL officers are addressed during discussion of the Navy's plan to select a cadre of 30 GURL officers for the specialist

track. The graduate education steady state quota model is used in Chapter V to show the potential impact of the specialist on total MPTA subspecialist inventories and NPS student inputs.

II. MPTA SUBSPECIALTY

"The Officer Subspecialty System is an integrated manpower and personnel classification and control system which establishes criteria and procedures for identifying officer requirements for advanced education, functional training, and significant experience in various fields and disciplines. Similiarly, the Subspecialty System is used to identify those officers who acquire these qualifications. In addition to identifying qualitative officer manpower needs, the subspecialty system is used as the basis for generating the Navy's advanced education and training program requirements." [Ref. 1: p. E-1]

The MPTA subspecialty is one of 56 subspecialties within the Officer Subspecialty System. A five character subspecialty code is used to identify both the billets which require the incumbent to possess specific skills and the officers who have acquired a certain level of education and/or experience in a skill area.

The first and second characters of the subspecialty code are used to identify one of eight functional fields. Those fields and their codes are:

20xx Public Affairs
30xx Intelligence

40xx Naval Warfare
50xx Command and Control
60xx Plans and Programs
70xx Pol-Mil/Strategic Planning
80xx Material Support
90xx Manpower-Personnel

With few exceptions, the MPTA subspecialty is assigned to the Manpower-Personnel functional area. Functional fields are assigned to URL officers in the grades of Lieutenant Commander through Captain as a result of subspecialty board action, and to billets requiring officers in those grades.

The third and fourth characters of the subspecialty code identify the educational/training/experience field of the officer and the billets requiring officers with education/training/experience in that field. A MPTA officer or billet will be identified by the second subset xx33.

The alphabetic suffix indicates the level of education/training/ experience as it pertains to the education/training/experience field.

Some billets require experienced subspecialists, individuals who have served one or more significant tours in their subspecialty. Lieutenant Commander through Captain subspecialists who have served such tours are reviewed by a selection board and chosen as "proven" subspecialists if they meet the criteria.

For the purposes of this research, only individuals and billets with the subspecialty code xx33P and xx33Q will be considered. The xx33P code is assigned to a MPTA subspecialist with a Master's degree or to a billet requiring such a subspecialist. The xx33Q code indicates the "proven" counterpart to the xx33P billet or subspecialist.

A. MPTA CURRICULUM HISTORY

The Navy's current MPTA subspecialty xx33 evolved from the Manpower/Personnel Management subspecialty xx36 during the late 1970's. In 1976, a study conducted by VADM R.S.Salzer, USN (Ret) provided the rationale for the change to the Manpower/Personnel Management curriculum. After the Salzer report, the staff of the Chief of Naval Personnel developed a revised curriculum which was the precursor to today's curriculum. A 1977 letter of the Chief of Naval Personnel gave the following justifications for the curriculum changes as highlighted in the Salzer report:

1. Navy long range needs in manpower/personnel management over the next 10-20 years reflect the areas where expertise needed. Some examples follow:
   a. Need to determine manpower requirements for the 1980's and 1990's
   b. Need to project the technological impacts on manpower demands
   c. Need for long term quantity and quality skill projections
   d. Need for determination of life cycle costing

e. Need for projections of national manpower pools
f. Need for determination of human component in systems design

2. Curricula should develop decision making and analytical competence in students rather than specialization in a discrete functional area.

3. Projected new Navy organization structure resulting from the Navy's Manpower and Personnel study (Salzer report) which consolidates most Navy manpower, training and personnel management functions into a single office is a significant indicator of the type of manpower/personnel managers needed to make the system work.

4. Courses "good to have" and which are less directly related to manpower/personnel functions were replaced by more critical courses.

5. Heavier emphasis was made on economic considerations, costing of manpower/personnel systems, overall integration of manpower/personnel systems. [Ref. 2: p. 5]

The revised Manpower/Personnel Analysis curriculum was originally proposed as a four, five, or six quarter graduate program in addition to the standard two quarters of prerequisite work. The six quarter program included a six week experience tour. After considerable negotiations between the Deputy Chief of Naval Operations (Manpower, Personnel, and Training) (OP-01) and the Naval Postgraduate School (NPS), the four quarter graduate program was selected. The curriculum has remained four quarters in length though some courses have been dropped, added, or modified in content. Training was added to the curriculum title as

recommended by the 1979 curriculum review board when a training requirements determination course was added to the curriculum. Figure 1 gives the current curriculum content as approved by the 1985 MPTA curriculum review board.

The MPTA curriculum content is driven by the sponsor's, OP-01, educational skill requirements (ESR's). The 1985 curriculum review board revised these ESR's and they are as follows:

1. The officer must have the ability to apply contemporary basic management principles and fundamentals to a broad range of situations in basic management functional areas.

2. The officer must have the ability to use and understand basic main-frame and micro computer systems in problem solving and analysis efforts, especially as they relate to existing and proposed compu terized management information systems within the Navy and DOD.

3. The officer must understand the potential basic application of the relevant social sciences to the effective operation of organizations and the behavior of the individuals who work in them.

4. The officer must understand and be able to apply a range of quantitative techniques to the analysis and study of major generic problems in the MPT areas.

5. The officer must understand and be able to evaluate the utility of general quantitative model development, use, and interrelationships in MPT requirements determination, recruiting, retention, planning, programming, and budget.

6. The officer must be able to analyze the strengths and weaknesses of proposed basic MPT policies and to suggest/develop alternatives

TITLE MANPOWER PERSONNEL TRAINING ANALYSIS (847)

EFFECTIVE JULY 1985

MANAGEMENT FUNDAMENTALS	QTR 1	MN 2031 ECONOMIC DECISION MAKING	MN 3333 MANAGERIAL COMMUNICATIONS SKILLS	MN 2150 FINANCIAL ACCOUNTING	MA 2300 MATHEMATICS FOR MANAGEMENT	MN 2111 SEMINAR IN MPTA ISSUES I	MN 2901 MPT COMPUTER SKILLS DEVELOPMENT
	QTR 2	MN 3140 MICROECONOMIC THEORY	MN 3105 ORGANIZATIONAL SYSTEMS	OS 3006 OPERATIONS RESEARCH FOR MANAGEMENT	OS 3105 PROBABILITY AND STATISTICS	MN 2112 SEMINAR IN MPTA ISSUES II	MN 3902 MPT COMPUTER SKILLS ENHANCEMENT
GRADUATE PROGRAMS	QTR 3	MN 3760 MANPOWER ECONOMIC	MN 3111 MANPOWER ANALYSIS	MN 3161 MANAGERIAL ACCOUNTING	OS 3106 PROBABILITY AND STATISTICS	MN 2113 SEMINAR IN MPTA ISSUES III	MN 3903 MPT COMPUTER APPLICATIONS
	QTR 4	MN 4761 MANPOWER ECONOMICS II	MN 4117 PRODUCTIVITY ANALYSIS	OS 4701 MANPOWER AND PERSONNEL MODELS	MN 4110 MULTIVARIATE MANPOWER DATA ANALYSIS	MN 2114 SEMINAR IN MPTA ISSUES IV	MN 4904 ADVANCED MPT COMPUTER APPLICATIONS
	QTR 5	CURRICULUM OPTION	MN 4106 MANPOWER/PERSONNEL POLICY ANALYSIS	MN 3172 PUBLIC POLICY PROCESSES	THESIS		
	QTR 6	CURRICULUM OPTION	MN 4105 MANAGEMENT POLICY	THESIS	THESIS		

Figure 1. Manpower, Personnel, and Training Analysis Curriculum effective July 1985.

which recognize the potential long and short run impacts on the full range of Navy/DOD programs, goals, and organizational components. [Ref. 3: p. 5]

The first student input to the new xx33 program occurred in January 1978. This group graduated in June 1979. Most student inputs occur at the winter and summer quarters of the academic year.

B. MPTA BILLETS

Prior to the graduation of the first NPS trained MPTA subspecialists, there were 88 billets in existence with a xx33P or xx33Q code. This number had grown to 108 by 1983. During the 1985 Subspecialty Requirements Board, 84 additional billets were designated as xx33P or Q bringing the current number of billets to 192. An increase of 29 billets occurred as a result of the establishment of the Navy Manpower Engineering Program (NAVMEP) while 28 xx36 billets were converted to xx33P and Q billets. The remaining 27 billets were added in response to specific subspecialty billet requests by commands. Table 1 provides a breakdown of the current 192 billets by required incumbent rank and billet designator code. The billet designator codes are also explained in Table 1.

C. MPTA SUBSPECIALISTS

Most Navy officers receive the xx33P subspecialty code as a result of completing the MPTA curriculum at the Naval Postgraduate School.

TABLE 1. TABLE OF 0033P AND 0033Q BILLETS.

Billet Designator Code	0033P Billets CAPT	CDR	LCDR	LT	0033Q Billets CAPT	CDR	LCDR	Total
1000	3	20	39	13	16	20	1	112
1050		4			1	2		7
1110		2	5	1	1	5		14
1120						1		1
1130			1					1
1300		2	6	1		6		15
1311			1	1				2
1312		1						1
1610		2	1	1				4
1630	1	1						2
2000	3	4	3					10
2300		7	10	4				21
2900			2					2
								192

Billet Designator Code

1000: Billet requires any Unrestricted Line (URL) officer

1050: Billet requires any warfare qualified URL officer

1110: Billet requires a Surface Warfare qualified officer

1120: Billet requires a Submarine Warfare qualified officer

1130: Billet requires a Special Warfare qualified officer

1300: Billet involves other than operational flying and requires an officer who is currently or previously designation as a pilot or naval flight officer (NFO)

1311: Billet involves Code 1-operational flying and requires the warfare specialty of a pilot

1312: Same as 1311 except Code 2-operational flying

TABLE1, CONTINUED. TABLE OF 0033P AND 0033Q BILLETS.

1610: Billet requires a Special Duty officer with a Cryptology specialty
1630: Billet requires a Special Duty officer with an Intelligence specialty
2000: Billet requires any Medical Department officer LCDR and above
2300: Billet requires a Medical Service Corps officer; MPTA billets are currently filled by Health Care Administrators only
2900: Billet requires a Nurse Corps officer

However, a few officers earn their Master's degrees at civilian universities either during off-duty hours or under a Navy fully funded graduate program and then apply for designation as a xx33P. Such requests are reviewed on a continual basis by the office of the Chief of Naval Operations, Total Force Training and Education Division (OP-11). If the Master's degree fulfills the necessary educational skill requirements, the officer is designated as a xx33P. These officers are called "lateral" entrants to the community of MPTA subspecialists.

Once a xx33P subspecialist has reached the rank of Lieutentant Commander and has served one or more significant tours in the MPTA arena, the officer can request designation as a proven subspecialist. The request goes before a biennial MPTA subspecialty selection board. If the officer is selected as a proven subspecialist, the P suffix is changed to

a Q and the appropriate functional field assigned, normally 90xx Manpower-Personnel. If not selected, the officer is still assigned a subspecialty functional field but the P suffix remains. The officer may reapply to the board after additional experience is acquired. Figure 2 is a flowchart of the process of becoming a xx33P subspecialist and a xx33Q proven subspecialist.

1. **Building the MPTA Community**

a. MPTA Recruits

In 1978, 11 officers entered the MPTA community by lateral entry from the xx36 subspecialty or the xx30 Management (General) subspecialty. One officer received the xx33P subspecialty code while the remaining ten were given a 9033Q proven subspecialist code. During the years 1979 through 1984, only twelve more officers were lateral entrants into the MPTA community. The number of laterals jumped considerably in 1985 due to increased awareness of the xx33 subspecialty and the elimination of xx36 billets. xx36 coded officers were encouraged to apply for redesignation as a MPTA subspecialist. Most xx36 officers needed additional quantitative course work to meet the MPTA ESR's and this discouraged and/or prevented a large number of officers from

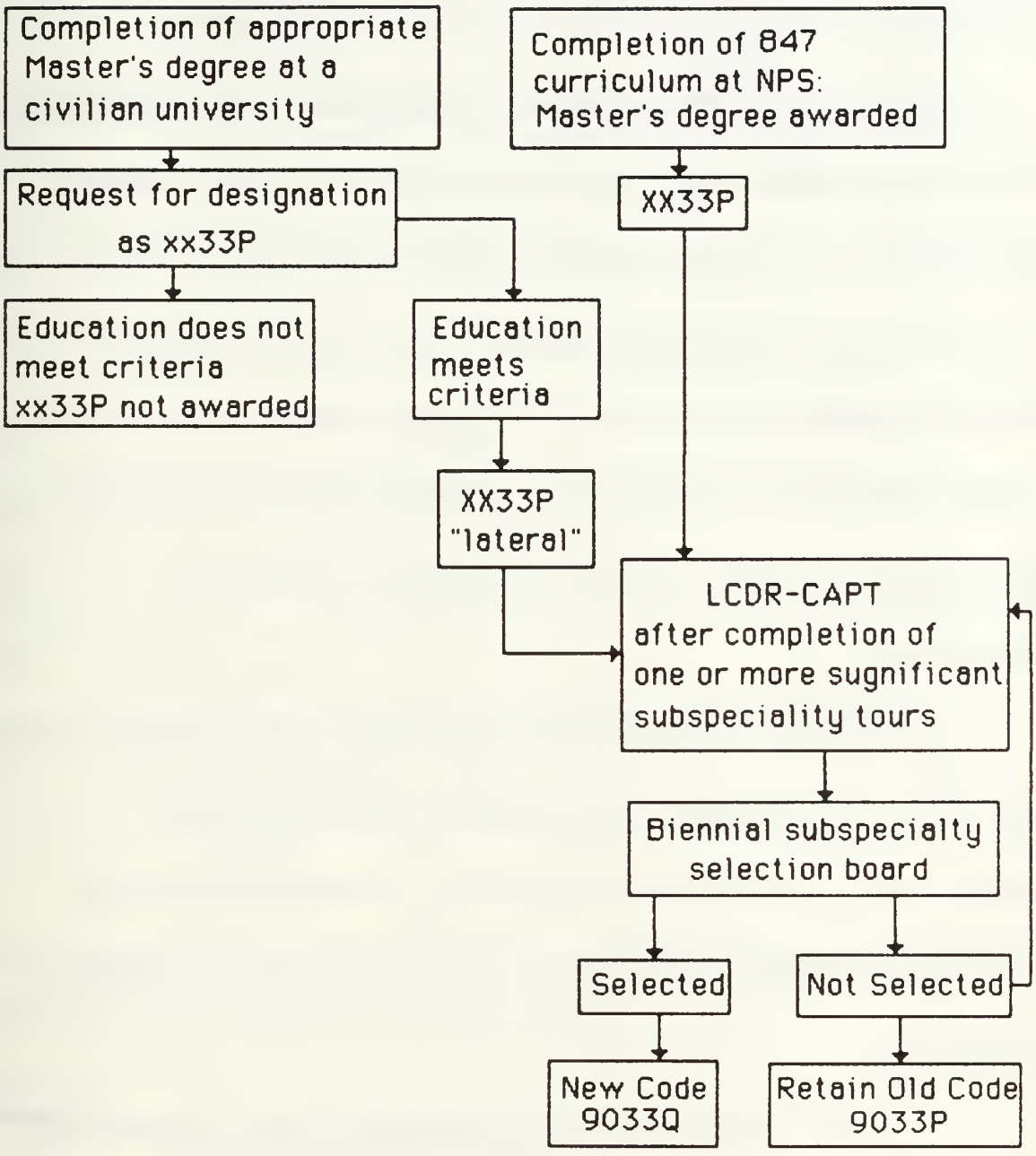

Completion of appropriate Master's degree at a civilian university
Completion of 847 curriculum at NPS: Master's degree awarded
Request for designation as xx33P
XX33P
Education does not meet criteria xx33P not awarded
Education meets criteria
XX33P "lateral"
LCDR-CAPT after completion of one or more sugnificant subspeciality tours
Biennial subspecialty selection board
Selected
Not Selected
New Code 9033Q
Retain Old Code 9033P

Figure 2. Flowchart of xx33P/Q Subspecialists.

applying for lateral entry into the MPTA community. Table 2 provides a summary of all lateral entrants by fiscal year and designator.

Of the 42 lateral entrants, 26 had completed Master's degrees through a Navy-sponsored program, 10 had completed Master's degrees unfunded, one officer had no Master's degree reflected in his file, and educational information was unavailable on five officers. Of the 36 Master's degrees completed, 30 were in business administration, two in personnel administration, one in ordance engineering, one in industrial engineering, one in public administration, and one in industrial management.

Even though lateral entrants occurred in large numbers in 1978 and 1985, it is not anticipated that they will make a significant contribution to building the MPTA community. The Naval Postgraduate School will continue to be the primary source of "recruits" into the MPTA subspecialty.

Table 3 is a summary of the NPS student inputs and graduates by fiscal year of graduation. Officers were grouped by fiscal year of graduation rather than fiscal year of entry at NPS because they are considered as entrants to the MPTA community at graduation. The information on classes graduating in fiscal years 1979-85 is based on

TABLE 2. XX33P/Q LATERAL ENTRANTS (BY DESIGNATOR) BY FISCAL YEAR.

	xx33P				xx33Q			
FY*	CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	TOTAL
78			1-1440		2-1110	1-1100 3-1110 1-1310	1-1100 2-1320	11
79		1-1520						1
80	1-1310 1-1310	2-1110			1-1110	1-1310		6
81				1-1320				1
82								
83				1-1120				1
84	1-1120	2-1110						3
85	1-1100 1-1110	1-1100 2-1110 1-1130 2-1310 1-1320 1-1510	1-1100 4-1310 1-1320	1-1100 1-1120 1-1320				19 42

* first time considered in inventory is on 1 October of fiscal year after subspecialty code appears in officer master file

Officer Designator

1100	General Unrestricted Line (GURL)
1110	Surface Warfare
1120	Submarine Warfare
1130	Special Warfare
1310	Pilot
1320	Naval Flight Officer (NFO)
1440	Engineering Duty Offcier (EDO)
1510	Aeronautical Engineering Duty Officer (Aeronautical Engineering)
1520	Aeronautical Engineering Duty Offcier (Aviation Maintenance)

TABLE 3. NPS MPTA STUDENT INPUTS AND GRADUATES BY FISCAL YEAR OF GRADUATION.

FY(1)	Student Input	Transfer Out(2)	Transfer In(3)	Attri-tion(4)	Grads (5)
79	11				11
80	21		+1	-2	20
81	15		+1	-1	15
82	18	-2		-1	15
83	25	-1			24
84	21				21
85	16		+2	-3	15
86	23	-3	+1	-2	19*
87	21	-1	+1		21*

(1) Fiscal year of graduation for student input
(2) Transfers out have historically gone to other Admininistrative Sciences curriculum
(3) Transfers in have historically come from technical curriculum, with one exception
(4) Attrition occurred due to personal or academic disenrollment and no degree awarded
(5) Some graduates completed the curriculum in less than 18 months and subsequently graduated in an earlier fiscal year than the one in which they had been scheduled to graduate. When this occurred, the individual was considered an input to the fiscal year of their actual graduation.
* Projected

historical data. The information for classes graduating in fiscal years 1986-7 is based on projected data.

During the fiscal years 1980-85, NPS averaged 18.3 graduates per year with a range of 15-24. The average student input was 19.3 with a range of 16-24. The total student input was 116 and the total number of graduates was 110. Based on this information, an attrition rate of 6/116 or 5.2% might be calculated for the MPTA curriculum. However the attrition rate of those who initially began their NPS studies in MPTA was 10/116 or 8.6%. Attrition from the MPTA curriculum occurred due to transfers to other curricula, disenrollments, and when individuals failed to complete their thesis and consequently no Master's degree was awarded. While this last group of individuals may receive a xx33 code, it will not be a xx33P code and therefore they were considered losses. Some losses were offset by transfers into the MPTA curriculum from other NPS curricula and thus the lower overall attrition rate. Table 3 provides information on the student inputs for classes graduating in fiscal years 1979-85. The information for classes in fiscal years 1986-7 is actual and therefore the projected number of graduates should be very close to the actual number who will graduate in those years.

Student inputs are expected to be 30 students per year starting in fiscal year 1987. If this input is achieved, the expected number of losses would be three, with one gain from a transfer in from other curricula. An input of 30 students would be projected to produce 28 graduates.

b. Past and Projected Inventories

Past inventories of xx33P/Q subspecialists for the beginning of fiscal years 1980-86 were obtained using historical data. Future inventories for the beginning of fiscal years 1987-88 were estimated from information on student inputs and losses, estimated promotion rates, and planned officer losses. First, the projected NPS graduates during FY 1985 were added to the 1 October 1985 inventory. Expected losses during FY 1986 such as retirements and twice fail of select (FOS) for lieutenant commander were substracted from the inventory. Then the remaining inventory was adjusted to reflect 1986 selection board actions. This process was repeated to obtain the 1 October 1987 inventory. Selection board actions for FY 1987 were projected using year group information. Lieutenants in year groups through May 1978, Lieutenant Commanders in year groups through 1972 and Commanders through year groups 1966 were considered eligible for promotion.

The promotion rates used were 85%, 75%, and 50% for selection to LCDR through CAPT respectively. These inventories did not include any lateral entrants, nor take into account any possible retirements. Using an average number of lateral entrants from the fiscal years 1979-84, two lateral entrants would be expected to enter the MPTA inventory during fiscal years 1987 and 1988. Table 4 is a summary of all inventories for fiscal years 1980-88.

2. **Post Education Availability and Utilization**

Upon completion of the MPTA curriculum, the new MPTA subspecialist is either available or unavailable to serve a MPTA utilization tour. URL officers who must serve an operational tour in the fleet or 1100 officers who must serve a leadership tour are considered unavailable. All other officers are considered available to serve a utilization tour. If an officer is assigned to a xx33P/Q billet or a closely related billet (i.e. a billet coded xx42, xx95, or xx36) he/she meets the utilization criteria acceptable to the Department of Defense Inspector General. When an officer is available to serve a utilization tour but is placed instead in a billet not coded for his/her specialty, the officer is classified as not utilized. Once an officer enters a subspeciality community, a subspecialty utilization code is used to show the quality of

TABLE 4. ACTUAL AND PROJECTED INVENTORIES OF XX33P/Q SUBSPECIALISTS BY FISCAL YEAR, DESIGNATOR, RANK.

	LT									LCDR								
FY(1)	80	81	82	83	84	85	86*	87*	88*	80	81	82	83	84	85	86*	87*	88*
Desig.																		
1100	1		2	1	3	7	8	10	8	2	3	4	7	10	11	12	14	18
1110	1	6	7	12	16	15	8	8	6		7	15	16	20	27	36	35	33
1120		1	1		1	1	1	1					1	1	1	2	2	2
1130								1						1	1	1	1	2
1140									1									
1300															1	1	1	1
1310	1	1	1		1	1	1			1	6	5	6	7	10	13	11	13
1320	1	1	4	3	3	2	2	2	2	3	2	2	4	5	5	7	8	6
1440										1								
1510															1	1	1	1
1520										1	1	1						
2300	1	2	2	2	3	2	3	4	2				1	1	3	3	5	8
2900						1	1	1	1	1	1	2	3	3	3	3	3	4
3100	1	1	1	1										1	1			

	CDR									CAPT								
FY(1)	80	81	82	83	84	85	86*	87*	88*	80	81	82	83	84	85	86*	87*	88*
Desig.																		
1100	1	1			2	3	5	6	8			1				1		
1110	3	3	4	5	6	9	13	20	27	3	3	3	4	3	2	4	3	5
1120									1						1	1	1	1
1130							2	2	2									
1140																		
1300																		
1310	1	3	3	2	3	4	8	11	10		1	1	1	1	1	2	3	5
1320		2	2	2	3	4	4	5	5									1
1510							1	1	1									
1520				1	1	1												
2300									1									
2900							2	2	3									

(1) Inventory on 1 October of Fiscal Year
*Projected Inventories

the match between the subspecialist and the billets to which assigned. The current officer subspecialty utilization codes are provided in Table 5.

Table 6 is a summary of the first, second, and third tour utilization of MPTA NPS graduates by utilization code and designator. Service schools, except service colleges, attended in preparation for a duty assignment were considered as part of that duty assignment. Service college attendance and assignment to a doctorate program were assigned a B utilization code. When, during a tour an officer filled two or more billets with different utilization codes , the utilization code of the billet held the longest was used. Table 6 includes all MPTA NPS graduates through the December 1985 graduating class since their next duty assignments are also known at this time.

a. URL Availability and Utilization

The information in Table 6 was condensed into three categories, operational, utilization, and nonutilization for unrestricted line officers. The operational category includes officers assigned an A utilization code. The utilization category is used for officers assigned to billets with a D or E code. Codes B, G, H, J, K, and L were grouped into the nonutilization category. Table 7 is the condensed version of Table 6. The 1100 (GURL) officers were shown separately because their availability and utilization

TABLE 5. OFFICER SUBSPECIALTY UTILIZATION CODES.*

Code	Definition
A	Operational tour required to maintain progression in warfare specialty or leadership tour essential to GURL career progression
B	Educational assignment (Service College, P.G. training, etc.)
C	Separation pending
D	Officer's graduate education field matches billet requirement
E	Officer's graduate education field closely matches billet requirement
G	Assignment utililizing officer's subspecialty in subspecialty billet not requiring education
H	Assignment utilizing officer's subspecialty in an uncoded billet
J	Officer has more than one subspecialty code and higher priority exists for utilization of SUB 2 or SUB 3
K	Billet is not a subspecialty coded billet but is considered a higher priority requirement
L	Nonutilization

*Ref. 4: pg II-16.

TABLE 6. FIRST, SECOND, AND THIRD TOUR UTILIZATION OF MPTA NPS GRADUATES BY UTILIZATION CODE AND DESIGNATOR.

First Tour	Designator								
Code	1100	1110	1120	1130	1310	1320	2300	2900	TOTAL
A	2	56	1	2	11	4			76
D	13	6			3	4	3	3	32
E	3				1				4
G	2			1					3
H	2				1				3
K						1			1
L	4	1			2	1	6	3	17
									136

Second Tour	Designator								
Code	1100	1110	1120	1130	1310	1320	2300	2900	TOTAL
A	6	28		1	4	3			42
D	1	7						1	9
E	1	1			1				3
B					3				3
G	1	1				1			3
H						1	1	1	3
J			1						1
K		1				1			2
L	1	2			1	1	3	1	9
									75

TABLE 6, CONTINUED. FIRST, SECOND, AND THIRD TOUR UTILIZATION OF MPTA NPS GRADUATES BY UTILIZATION CODE AND DESIGNATOR.

Third Tour Code	Designator								
	1100	1110	1120	1130	1310	1320	2300	2900	TOTAL
A		5	1		1	1			8
D	1	3			1				5
E	1								1
B		2						1	3
G		3							
J						1			1
K	1	1			1	1			4
L		5				1	1	1	8
									57

TABLE 7. FIRST, SECOND, AND THIRD TOUR AVAILABILITY AND UTILIZATION OF URL NPS MPTA GRADUATES.

First Tour	Utilization of all graduates			Utilization of available graduates		
	1100	other URL	all URL	1100	other URL	all URL
OPER.	2 (8%)	74 (78%)	76 (63%)			
UTIL.	16 (61%)	14 (15%)	30 (25%)	16 (66%)	14 (66%)	30(66%)
NON-UTIL.	8 (31%) 26	7 (7%) 95	15 (12%) 121	8 (33%) 24	7 (33%) 21	15(33%) 45

Second Tour	Utilization of all graduates			Utilization of available graduates		
	1100	other URL	all URL	1100	other URL	all URL
OPER.	6 (60%)	36 (62%)	42 (62%)			
UTIL.	2 (20%)	9 (16%)	11 (16%)	2 (50%)	9 (41%)	11(42%)
NON-UTIL.	2 (20%) 10	13 (22%) 58	15 (22%) 68	2 (50%) 4	13(59%) 22	15(58%) 26

Third Tour	Utilization of all graduates			Utilization of available graduates		
	1100	other URL	all URL	1100	other URL	all URL
OPER.		8 (30%)	8 (27%)			
UTIL.	2 (66%)	4 (15%)	6 (20%)	2 (66%)	4 (21%)	6 (27%)
NON-UTIL.	1 (33%) 3	15(55%) 27	16 (53%) 30	1 (33%) 3	15(79%) 19	16(73%) 22

is significantly different from other URL officers. The remaining URL officers were put in the other URL category. An all URL category is provided to show the effect of aggregating all URL officers on availability and utilization rates. This table facilitates an analysis as to what extent the URL graduates have been utilized according to DOD policy for officers with funded graduate level education. That policy states that officers will serve:

1. One tour in a validated positon as soon as practicable after completion of such education, but not later than a second tour. Particular emphasis should be placed on early assignment of technically skilled graduate personnel.

2. As many subsequent tours in validated positions as Service requirements and proper career development, including command assignment, will permit. A minimum of two tours is desirable. [Ref. 5: p. 5]

During the first tour after graduation, two (or 8%) of the 1100 officers and 74 (or 78%) of the other URL officers were assigned to operational tours and therefore unavailable for utilization. Following postgraduate school, the two 1100 officers had an immediate need to serve a leadership tour. The other URL officers were needed in fleet or squadron billets to satisfy Navy and/or career progression requirements. The remaining 24 (or 92%) of 1100 officers and 21 or (22%) of all other URL officers were available for subspecialty utilization. Two thirds of

each group were or are being utilized during their first tour. So even though there was a considerably smaller percentage of other URL officers available, their utilization percentage was identical to that of the 1100 officers. Of the 26 1100 graduates, 16 were assigned to utilization tours compared to only 14 of 95 other URL officers.

Second tour utilization for 1100 and all other URL officers is very similiar. However, since only ten 1100 officers have moved to their second tour, the data is inconclusive for that group Sixty percent of the 1100 officers fell into the operational/leadership category, while 62% of the other URL officers were in operational billets during their second tour. Although not shown in Table 7, when surface warfare officers are separated from the remaining warfare officers, the result is a 70% operational rate for the 1110's and an overall 56% operational rate for the other warfare officers. This difference can be partially explained by differences in the surface warfare officer career pattern. Surface officers normally serve two eighteen month operational tours after postgraduate school, while aviators serve a thirty month operational tour. Fewer 1100 officers were available for second tour utilization due to assignment to leadership billets, particularly executive officer billets, than during their first tour. During their second tour, a larger percentage,

38% vice 22% during their first tour, of other URL officers were available for utilization though a smaller percentage of those available were actually utilized.

Even though few MPTA NPS graduates have moved to their third tour, one trend is worthy of mention. While 70% of the other URL officers were available for utilization, only 21% of those available were assigned to utilization tours. As the MPTA subspecialist gains seniority, other billets such as commanding officer ashore and staff positions are often assigned instead of utilization billets.

b. Medical Department Personnel Availability and Utilization

The utilization of Medical Service Corps (2300) and Nurse Corps (2900) officers who graduated in 1979-83 has been very low despite few encumbrances to their availability. Eight officers graduated during that period yet there has been a total of thirty months utilization between them to date. However, four of four 1984-5 Medical Department graduates are serving utilization tours while two of three 1986 graduates will be utilized upon graduation. Though no definitive statement can be made, it appears that new graduate utilization will remain high for Medical Department personnel.

c. Predicting Fill Rates of xx33P/Q Billets

Three methods were used to predict the number of xx33P/Q billets that would be filled by MPTA subspecialists. The data in Table 6 was aggregated into three categories, not available/operational, utilized, and not utilized, for all three tours. The aggregated data is shown in Table 8. There was a total of 244 assignments for which 52% of the officers were unavailable, 22% were utilized, and 26% were not utilized.

These figures compared favorably to data collected by the office of the Chief of Naval Operations, Officer Community Management Section, (OP-130E) for their quarterly graduate utilization reports. The aggregate data for January 1984 through June 1985 as reported by that office [Ref. 6-7] is as follows:

total	transferred:	52
	unavailable:	25 (48%)
	utilized:	12 (23%)
	not utilized:	15 (29%)

The third method used was a point in time look at utilization. The utilization status of MPTA subspecialists was tabulated for the date 14 November 1985. There were 141 xx33P/Q subpecialists of whom 27 filled xx33P/Q, xx36P/Q, xx42P/Q, or xx95P/Q billets. This equates to 19% of the MPTA inventory in filled billets. Nine xx33P/Q subspecialists

TABLE 8. AGGREGATED AVAILABILITY AND UTILIZATION OF ALL MPTA GRADUATES.

ALL TOURS

Utilization of all MPTA Graduates

	1100	other URL	2300	2900	all MPTA
OPS.	8(21%)	118(66%)			126(52%)
UTIL.	20(51%)	27(15%)	3(21%)	4(36%)	54(22%)
NON-UTIL.	11(28%) 39	35(19%) 180	11(79%) 14	7(64%) 11	64(26%) 244

ALL TOURS

Utilization of Available MPTA Graduates

	1100	other URL	2300	2900	all MPTA
UTIL.	20(65%)	27(44%)	3(21%)	4(36%)	54(46%)
NON-UTIL.	11(35%) 31	35(56%) 62	11(79%) 14	7(64%) 11	64(54%) 118

were in other xx33 billets. If they had been assigned to xx33P/Q billets, the percent in filled billets would have been 26%.

The number of filled xx33P/Q billets could be estimated by multiplying the expected inventory size by 19-26%. For example, using the projected 1 October 1987 inventory of 176 URL and Medical Department officers found in Table 4, it could be estimated that 176 x .19 to 176 x .26 or 34-46 billets would be filled if these trends continue.

d. Graduate Cohort Utilization Tour Completion

While Tables 6 and 7 provide information on MPTA subspecialist availability and utilization, it does not show how many MPTA graduates have served at least one utilization tour. Table 9 provides information on the number of MPTA graduates from fiscal years 1979-84 who have served at least one utilization tour. An officer was given credit for a utilization tour if he/she served at least 12 months in a billet which resulted in a D or E utilization code. It was assumed that any officer currently in a filled billet would complete at least 12 months in that billet and therefore was considered as having completed a utilization tour.

Intuitively one would expect the percentage of officers utilized to increase as the time since graduation increased. However, this has not occurred with the MPTA graduates. The fiscal year 1981

TABLE 9. UTILIZATION TOUR COMPLETION OF MPTA NPS GRADUATES.

FY of graduation	# of grads	number utilized	percent utilized	% LCDR's in cohort
79	11	5	45%	18%
80	20	6	30%	45%
81	15	11	73%	80%
82	15	3	20%	33%
83	24	11	46%	58%
84	21	6	29%	57%

cohort has experienced much higher utilization than any other cohort. The utilization tour completion rate of that group has been 73%, compared to the next highest rate of 46% for FY 1983. There was one characteristic of the 1981 cohort that distinguished it from the others. It was the cohort in which the highest percent of LCDR's were present at time of graduation. The 1983 cohort had the next largest percent of LCDR's, 58%, and this cohort has experienced the next highest utilization tour completion rate of NPS graduates.

3. Balance within the MPTA Community

By 1 October 1987, the MPTA community will have an inventory of approximately 178 subspecialists. This is a conservative estimate because it was obtained without adding lateral entrants to the 1987 and 1988 fiscal year inventories. Even though there will be a shortage of MPTA subspecialists overall when compared to total billet requirements, some designators will have a sufficient number of subspecialists for its individual designator subspecialist requirements. Table 10 shows the expected inventory on 1 October 1987 and the number of designator specific billets. Unrestricted line (URL), restricted line (RL), and Medical Department requirements and inventory will be discussed separately.

TABLE 10. PROJECTED MPTA INVENTORY ON 1 OCTOBER 1987/ NUMBER OF DESIGNATOR SPECIFIC BILLETS.

	Officer Designator	CAPT	CDR	LCDR	LT
GURL	1100		8	18	8
SURFACE	1110	5/1	27/7	33/5	6/1
SUBMARINE	1120	1	1/1	2	
UDT/SEAL	1130		2/1	2	
SPECIAL OPS	1140				1
PREVIOUS 1310/20	1300			1	
PILOT	1310	5	10/1	13/1	0/1
NFO	1320	1	5	6	2
AEDO	1510		1	1	
CRYPTOLOGY	1610		0/2	0/1	0/1
INTELLIGENCE	1630	0/1	0/1		
MEDICAL SERVICE	2300		1/7	8/10	2/4
NURSE	2900		3	4/2	1

Billet Designator		CAPT	CDR	LCDR	LT
ANY URL	1000	0/19	0/40	0/40	0/13
ANY AIR WARFARE	1300		0/8	0/6	0/1
ANY MEDICAL DEPT	2000	0/3	0/4	0/3	

The URL community has MPTA billets which require the primary specialty of a surface, submarine and special warfare officer or a pilot. If an optimistic 25 % utilization of the inventory is used, each of these designators will have enough MPTA subspecialists to fill their specific requirements. In fact, the surface and pilot communities have an excess of MPTA subspecialists, if only designator specific billets are considered. There will be 71 surface warfare officers to fill 14 billets or a 5:1 ratio, while there will be over 9 pilots for every 1310 MPTA billet. However, because there will be a shortage of URL officers overall, these excess surface warfare officers and pilots can be used to fill 1000 billets which require any URL officer. In light of the high cost of pilot training and reoccurring pilot shortages, however, the aviation community should review its assignment of pilots to the MPTA curriculum. An inventory of approximately twelve pilots would be needed to fill the three billets requiring the warfare specialty of a pilot. The remaining fifteen aviation specific billets could be filled by Naval Flight officers and most likely at a lower billet cost.

By 1 October 1987, the restricted line community will not have any MPTA subspecialists whose primary specialty is Cryptology (1610) or

Intelligence (1630). If the billet requirements are valid, there are no other MPTA subspecialists who could adequately fill these billets.

The Medical Department is projected to have only 11 Medical Service Corps (MSC) officers to fill 21 MSC specific billets (2300), while it is expected to have 8 nurses to fill two Nurse Corps (NC) specific billets (2900). Like the aviation community, the Medical Department should evaluate its assignment of MSC and NC officers to postgraduate school. Ten Medical Department MPTA billets can be filled by either and MSC or NC officer and therefore the cost and benefits of assigning NC versus MSC officers should be assessed more fully.

III. MARKOV MODEL FOR THE MPTA SUBSPECIALITY

In the management of a subspecialty, it is useful to know the location of the subspecialists in relation to subspecialty billets. For purposes of subspecialty management, the subspecialist can be considered in one of three locations: (1) in an operational/leadership billet (not available--OPS); (2) in a billet coded for his/her subspecialty (utilized--UTIL); and (3) in a billet other than the above two (not utilized--NON-UTIL). A subspecialty billet is considered to be properly filled when the individual occupying that billet possesses the requisite subspecialty code. While it is relatively easy to determine the current billet type of subspecialists from the officer master file, that information often does not provide insight about their future billet type. The subspecialist manager may have a number of questions such as:

What will be the distribution of subspecialists in billet types in the next 2, 5, or 10 years?

What distribution will result if the number of recruits is changed?

How will the distribution change if recruits enter the system in the three types of billets in proportions different from the previous one?

A Markov chain model can be used to make forecasts and provide insight

about such questions. "The assumptions for the Markov chain are that individuals move independently and with identical probabilities which do not vary over time." [Ref. 8: p.87] Historical data about MPTA subspecialist movements was used to estimate the transition probabilities from and to each of the three billet types.

A. DEVELOPING THE MODEL

Two Markov model applications were developed in which MPTA subspecialists were classified according to their billet types at the beginning and at the end of fiscal years 1982-85. The first application included only warfare qualified URL officers, while the second included all URL officers. This information was used to compute the number of transitions that occurred during those fiscal years among every two billet types. From these numbers, transition probabilities for the three billet types were estimated using the techniques explained in Chapter 4 of Reference 8.

These transition probabilities were arranged in a transition matrix for each application and each of the four fiscal years. The matrices are given in Tables 11 and 12 for warfare and all URL officers, respectively. The number of transitions that occurred are also shown in the same tables. The number of losses that occurred during the year are shown in

TABLE 11. TRANSITION MATRICES FOR WARFARE OFFICERS FOR YEARS 1982-85.

TO

FROM 1982	OPS	UTIL	NON-UTIL	LOSS
OPS	24 .857	1 .036	2 .071	1
UTIL	2 .333	4 .667	0 0.0	0
NON-UTIL	0 0.0	0 0.0	2 1.0	0

1983	OPS	UTIL	NON-UTIL	LOSS
OPS	28 .778	3 .083	5 .139	0
UTIL	3 .60	2 .40	0 0.0	0
NON-UTIL	1 .20	0 0.0	4 .80	0

1984	OPS	UTIL	NON-UTIL	LOSS
OPS	32 .744	4 .093	6 .140	1
UTIL	1 .125	7 .875	0 0.0	0
NON-UTIL	2 .182	1 .091	8 .727	0

1985	OPS	UTIL	NON-UTIL	LOSS
OPS	34 .739	4 .087	7 .152	1
UTIL	5 .357	9 .643	0 0.0	0
NON-UTIL	2 .143	0 0.0	11 .786	1

COMBINED	OPS	UTIL	NON-UTIL	LOSS
OPS	118 .771	12 .078	20 .131	3
UTIL	11 .333	22 .667	0 0.0	0
NON-UTIL	5 .156	1 .031	25 .781	1

AVERAGE RECRUITMENT=16.75 (10.5,4.25,2)

(1) UPPER NUMBER IN EACH CELL IS NUMBER OF TRANSITIONS
(2) LOWER NUMBER IS THE TRANSITION PROBABILITY

TABLE 12. TRANSITION MATRICES FOR ALL URL OFFICERS FOR YEARS 1982-85.

TO

1982 FROM	OPS	UTIL	NON-UTIL	LOSS
OPS	24 .857	1 .036	2 .107	1
UTIL	3 .333	6 .667	0 0.0	0
NON-UTIL	1 .250	1 .250	2 .500	0

1983 FROM	OPS	UTIL	NON-UTIL	LOSS
OPS	30 .789	3 .079	5 .132	0
UTIL	4 .444	5 .556	0 0.0	0
NON-UTIL	1 .167	0 0.0	5 .833	0

1984 FROM	OPS	UTIL	NON-UTIL	LOSS
OPS	36 .766	4 .085	6 .128	1
UTIL	2 .133	12 .800	1 .067	0
NON-UTIL	2 .143	1 .071	11 .786	0

1985 FROM	OPS	UTIL	NON-UTIL	LOSS
OPS	37 .712	7 .135	7 .135	1
UTIL	6 .261	13 .565	3 .130	1
NON-UTIL	2 .105	1 .053	15 .789	1

COMBINED	OPS	UTIL	NON-UTIL	LOSS
OPS	127 .770	15 .091	20 .121	3
UTIL	15 .268	36 .643	4 .071	1
NON-UTIL	6 .140	3 .070	33 .767	1

AVERAGE RECRUITMENT=12.25 (10, 1.5,.75)

(1) UPPER NUMBER IN EACH CELL IS NUMBER OF TRANSITIONS

(2) LOWER NUMBER IS THE TRANSITION PROBABILITY

an extra column at the far right-hand side of each transition matrix. A combined matrix for the four years was also computed for each application.

The recruits into the system were NPS graduates. They were classified by type of billet assigned immediately following graduation. It was assumed that a fiscal year's graduates entered the system at the beginning of the following fiscal year.

B. EVALUATING THE TRANSITION PROBABILITIES

The transition probabilities, "flow rates", were analyzed using techniques recommended in Reference 8 to determine whether the annual fluctuations were due to chance or systematic factors. This was done by first plotting the point estimates of each matrix cell, together with the four year, combined estimate as suggested in Reference 8. Next, a confidence interval was determined for each cell's combined estimate based on its standard error. The confidence interval was plotted on the graph as a dotted line. The graphs of flow rates for warfare officers can be found in Figure 3 and the graphs for all URL officers in Figure 4. The confidence intervals do not appear on some graphs because all points fell well within the confidence interval.

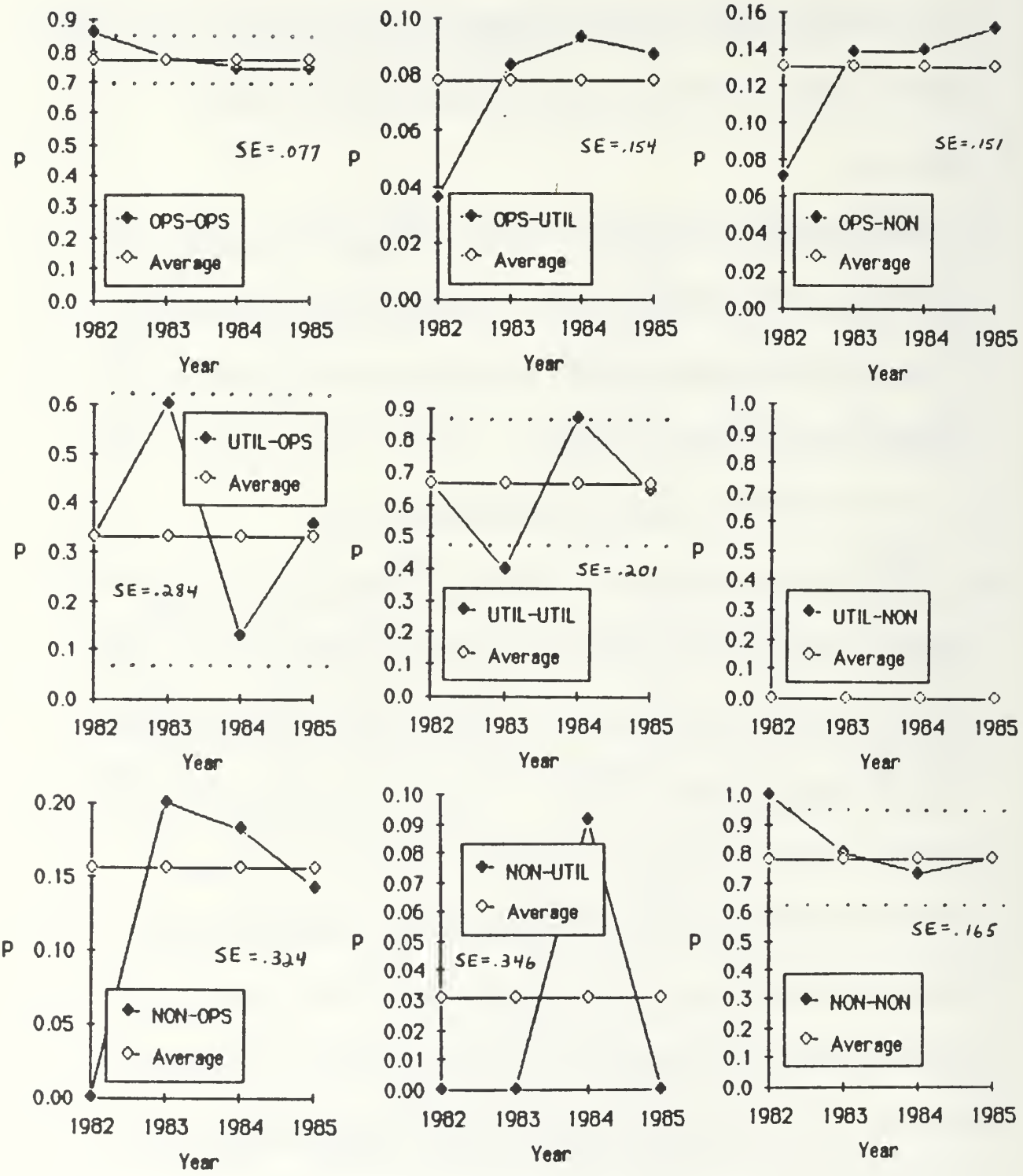


Figure 3. Graphs of Transition Probabilities for Warfare Officers.

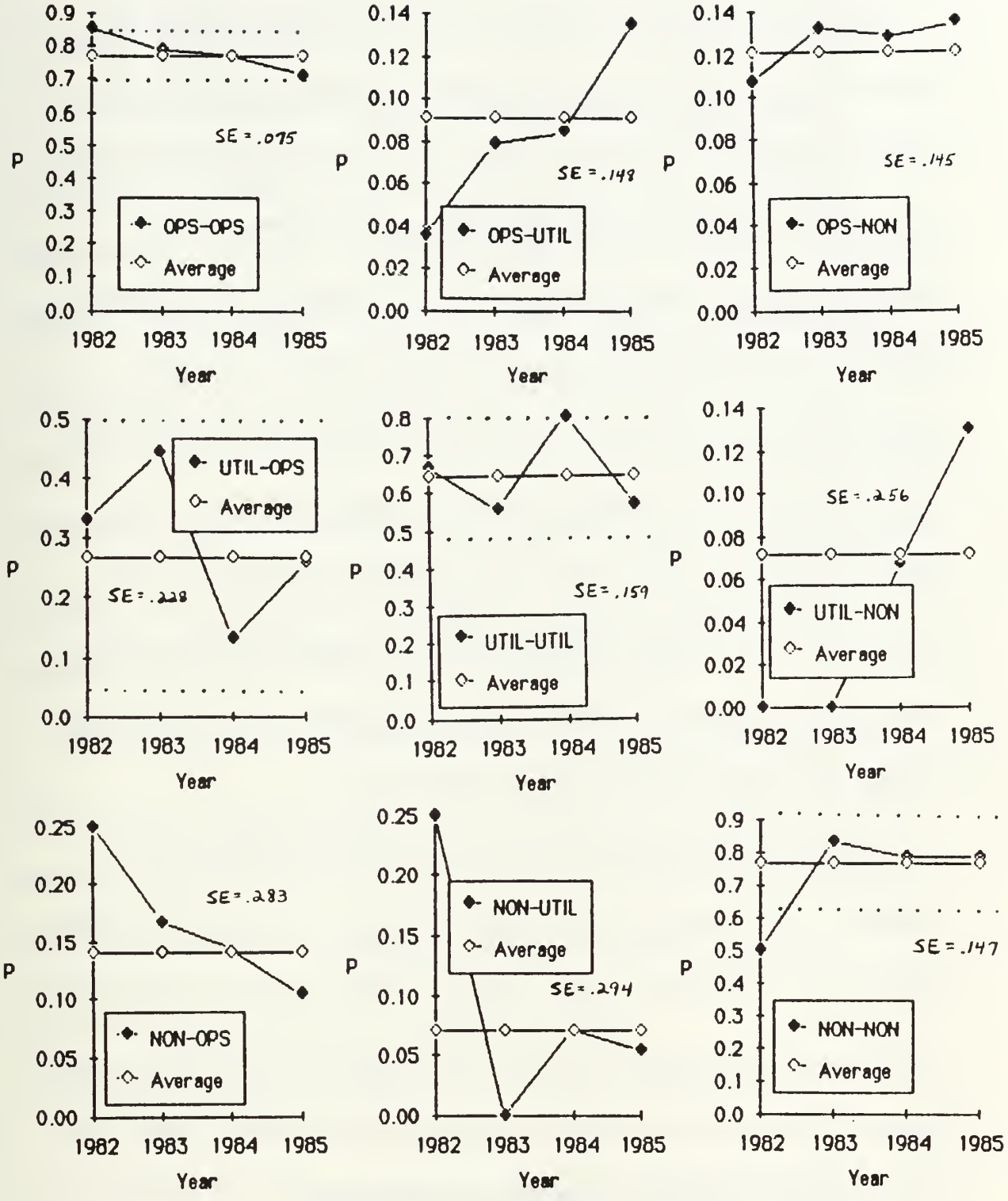


Figure 4. Graphs of Transition Probabilities for all URL Officers.

There were four point estimates that fell outside the confidence intervals for warfare officers. They were the 1982 OPS to OPS and NON-UTIL to NON-UTIL rates, the 1983 UTIL to UTIL rate, and the 1984 UTIL to UTIL rate. Because the confidence interval represents one standard deviation in each direction from the combined point estimate, 68% of the annual point estimates are expected to fall within the confidence interval. This was the case for the OPS to OPS and NON-UTIL to NON-UTIL point estimates and therefore no systematic trend was suspected. However, two of four point estimates for the UTIL to UTIL flow rate fell outside the confidence interval, suggesting that perhaps the rates have not been constant over the four years. However there are too few data points to draw any hard conclusions.

Two point estimates fell outside the confidence intervals for the combined flow rates of all URL officers. They were the 1982 OPS to OPS and NON-UTIL to NON-UTIL rates. However, 75% of the point estimates for the OPS to OPS and NON-UTIL to NON-UTIL rates fell within the confidence intervals and therefore no systematic trend was suspected. Again, there are too few data points to draw any firm conclusions.

C. MODEL VALIDATION

If flow rates had been known for more than four years, model validation would have attempted using the first half of the historical data to predict the later half. However, this method of model validation was not considered appropriate in this case. Instead the combined flow rate was used to predict the stocks and flows for 1983-85, using the beginning stocks for 1982. The results of the model runs can be found in Appendices A and B for warfare officers and all URL officers respectively. The actual beginning stocks for fiscal years 1982-85 appear in the appendices at the far right under the heading ***Actual***.

Both models produced similiar results in that both under-predicted the 1983 total beginning stocks, over-predicted the 1984 and 1985 total beginning stocks and exactly predicted the 1986 total beginning stocks. The actual and predicted stocks for each year and billet type were compared and a percent error computed as follows:

$$\frac{\text{actual stock} - \text{predicted stock}}{\text{actual stock}} \times 100 = \text{percent error}$$

If the percent error is everywhere less than 10%, the model may be considered an acceptable predictor. In both models, there were four out of twelve beginning stocks which had a percent error greater than 10%.

These errors occurred in the FY 1983-85 stocks. The FY 1986 stocks had no percent error greater than 10%.

Overall, the model results were still acceptable due to the fact that they are based on a very small amount of data. Because the comparative results of the two models were so similiar, there did not appear to be any immediate improvement gained in model performance by separating the warfare officers from the GURL officers.

D. FORECASTING WITH THE MODEL

The Markov model developed for the MPTA subspecialists can be used to predict future stocks and flows. However, now it becomes a question of which transition matrix to use when making the forecasts. The manager may decide that the combined transition probabilities predict reasonably well or may decide that the most recent probabilities more accurately reflect continuing trends in subspecialist assignments and utilizations.

Both models were used to forecast future stocks for the next three years. The actual beginning stocks for FY 1986 were used together with the 1985 transition matrix. The average recruitment proportion was used because the number of recruits is not expected to increase significantly

during the next three years. The results of these model runs can be found in Appendices C and D for warfare and all URL officers respectively.

E. CONCLUSIONS

There appears to be a great deal of turbulence in the MPTA community. The most likely explanation for this turbulence is the newness of the subspecialty. The first "recruits" have only been in the community for 6-7 years. Most officers are still serving obligated service resulting from their attendance at NPS and therefore little attrition has occurred. Also, no NPS graduates have retired to date. The steady state stocks are not indicative of expected results because the computed wastage rates are unusually low due to the factors mentioned.

Because of this turbulence and the sparsity data, the model results are somewhat inconclusive. However, the model shows promise as a forecasting tool once additional data becomes available to allow for a more complete model validation process.

IV. SPECIALISTS, THE NEW WAVE

A. THE SPECIALIST TRACK

In 1984, a study group was formed by OP-130 to review all areas of the General Unrestricted Line (GURL) 1100 career pattern. This followed a previous study which had been completed in 1979. During the interim five years, the GURL community had grown from less than 1700 officers to over 3000. As the size and seniority of the community increased, Executive Officer (XO) and Commanding Officer (CO) opportunities began to steadily decrease as more officers became eligible for these assignments without a concomitant increase in billets. At the same time, the Navy's demand for subspecialists was increasing. Although numerous issues were addressed by the 1984 study group, the following findings are considered particularly relevant for this thesis research:

> *While a decreasing percentage of General URL officers can serve in LCDR XO assignments, more will have the technical background to fill Navy requirements for subspecialists.
>
> *A separate subspecialty only track is needed in the career pattern. [Ref. 9: p. v]

The study group recommended that the GURL career path be split at the LCDR level into two different tracks, a leadership/subspecialist track

and a subspecialty only track. Figure 5 illustrates the new GURL career pattern that was proposed by the study group to incorporate the two tracks. It provided basic career guidance for any GURL community member regardless of subspecialty.

The recommendation for a dual track GURL career pattern was approved by the Chief of Naval Operations. The new track was called the specialist track and GURL officers within this track were to be called specialists. Only officers who are competitive for promotion within the GURL community will be considered for the specialist program. Individuals who are selected as proven subspecialists by the biennial subspeciality board will automatically be considered for the specialist track. Most specialists will enter the specialist track as LCDR's though some LT's will be accepted if they meet the criteria set by the specific subspecialty sponsor. Navy policy dictates that officers be assigned only to billets within their subspecialty once they enter the specialist track.

B. THE MPTA SPECIALIST

The MPTA subspeciality will be one of nineteen subspecialties to have specialists. The first MPTA specialists will be selected by the March 1986 subspecialty selection board. This board will select up to

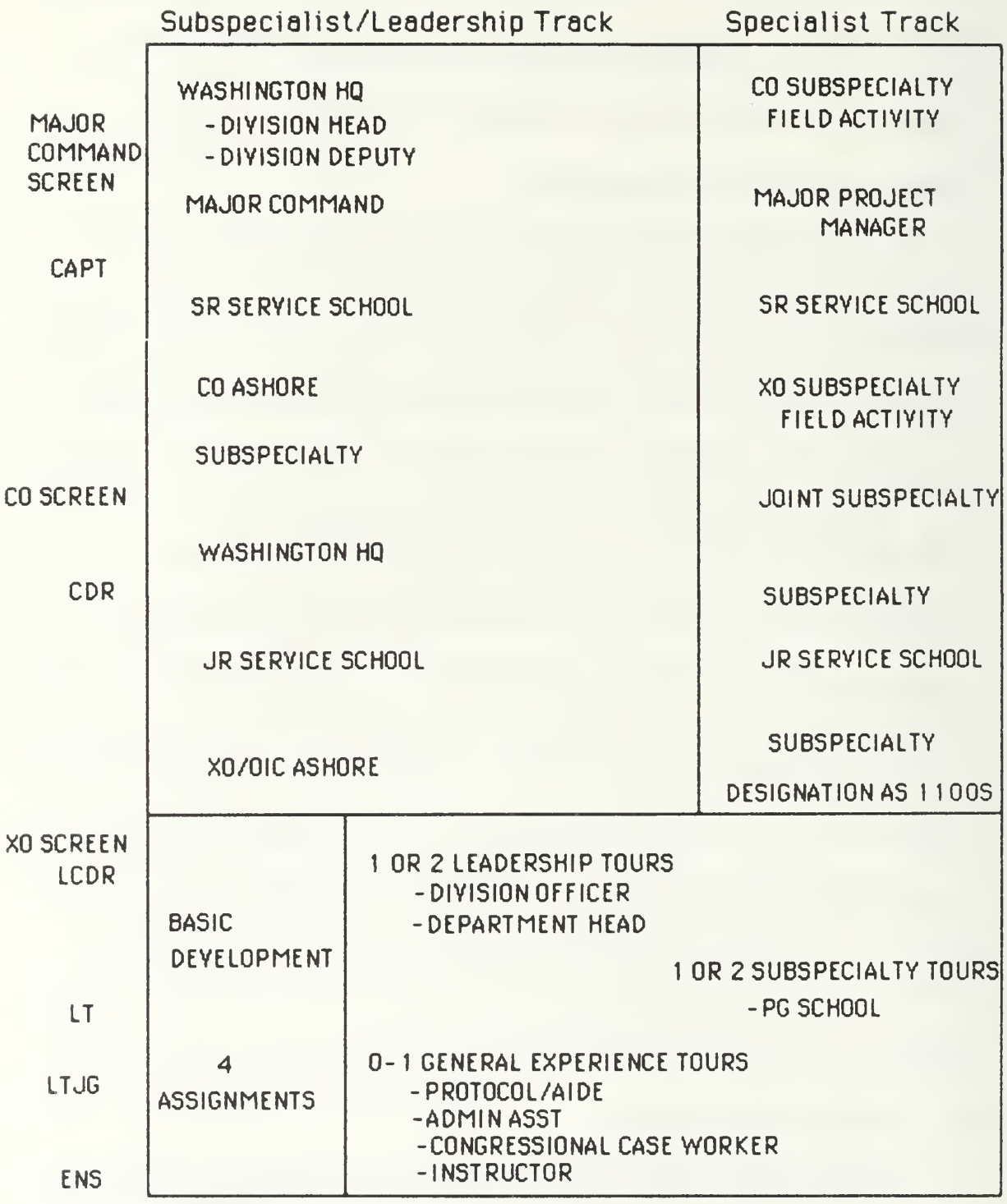
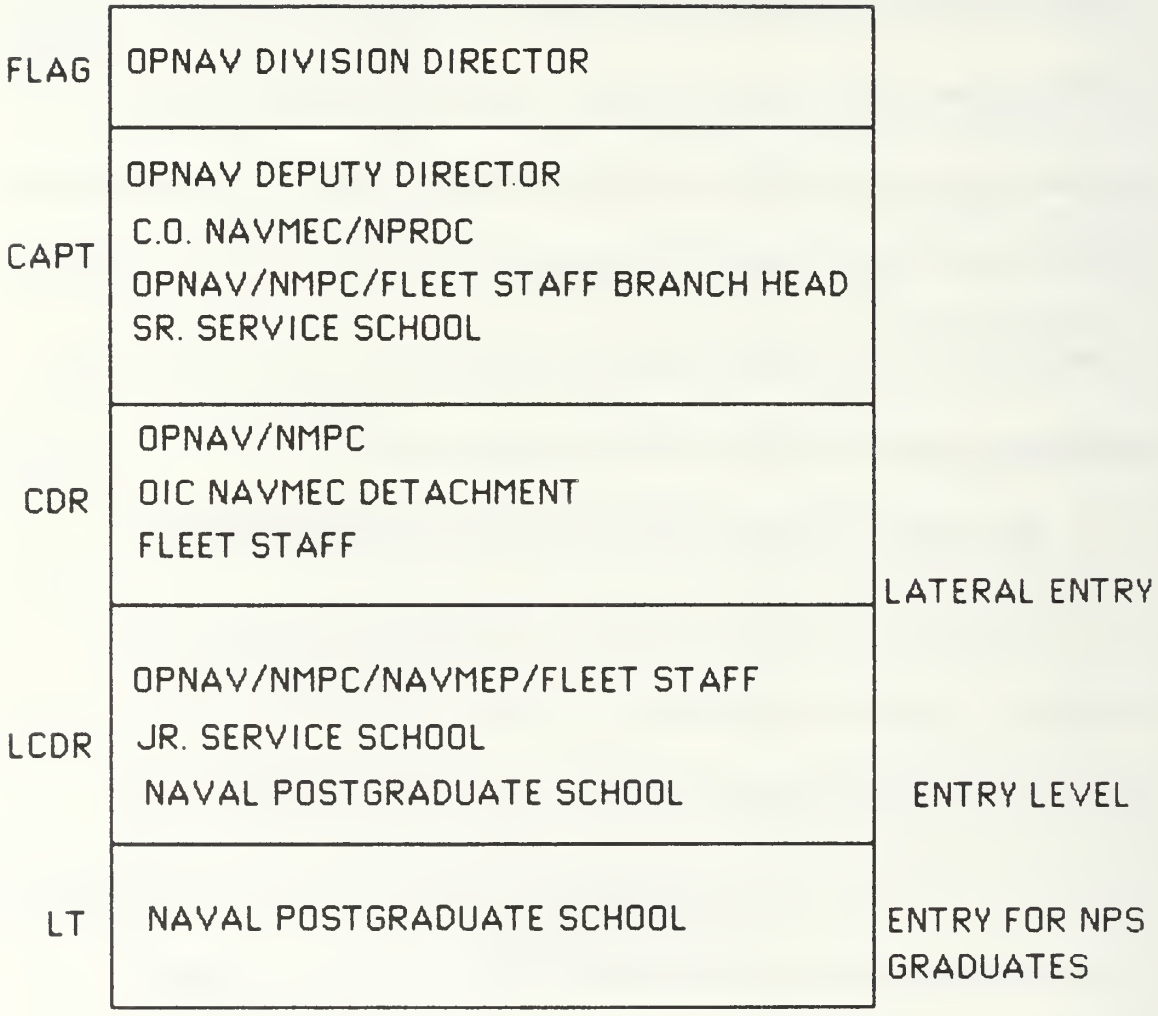


Figure 5. GURL Dual Track Career Pattern.

fifteen specialists toward a total strength of thirty specialists. Most MPTA subspecialtists will enter the specialist track at the LCDR level though some commanders and lieutenants will also be considered. Only MPTA subspecialists who hold xx33P/Q subspecialty codes and have eighteen months in a xx33 coded billet will be eligible for selection to the specialist track. Figure 6 illustrates the informal MPTA specialist career pattern. It is helpful as a guide to show the types of billets and assignments that the MPTA specialist could possibly fill.

1. **Are There Enough 1100's for the Specialist Track?**

Based on the current inventory, fifteen GURL officers will be eligible for specialist selection by the March 1986 board, that is assuming all fifteen officers are also competitive within the GURL community. Even if all fifteen officers are selected as specialists, there is no guarantee that all will accept the designation as a specialist. Because the subspecialty selection board meets biennially, the next MPTA specialists will not be selected until 1988. Assuming there are no GURL lateral entrants to the MPTA community and that all current GURL subspecialists complete the necessary eighteen months in a xx33 billet, there will be thirteen additional officers for consideration by the FY 88 board. Therefore, it would be optimistic to expect to achieve a total



*Billets listed are not intended to be exclusively for MPTA specialists. Career pattern is to be used as a guide and depicts a progression of assignments required to develop expertise across the MPTA spectrum.

Figure 6. MPTA Specialist Career Pattern.

strength of thirty specialists by 1988. This could only occur if there was a large influx of lateral entrants. Six of forty-two lateral entrants were GURL's during 1979-85. Five additional GURL subspecialists along with those graduating from NPS in December 1987 could be eligible for the 1990 board. However, by 1990, five of the current GURL subspecialists will have twenty or more years of service and several may become lost to the inventory. Therefore, a total strength of thirty specialists might be attained by 1990 if:

- -there is an offsetting number of lateral entrants to counter any attrition
- -at least five GURL's graduate from NPS in December 1987
- -all MPTA GURL's have completed an eighteen month xx33 tour prior to the 1990 board
- -80% of the GURL's selected, accept designation as a specialist

2. Other Sources for more MPTA Subspecialists

The process of building to a total strength of thirty MPTA specialists promises to be slow and somewhat uncertain with no assurance of goal achievement by 1990. Short of a survey, there is no way to determine GURL acceptance of the specialist track, at least until the first board is completed. The first specialists selected may be hesitant to accept this designation and the transition into a new, unknown career path. Due to the paucity of eligible GURL's, it is important that those

selected accept the designation or the strength goal may not be attained until the 1992's board. The Navy can improve its chances of meeting this goal by 1990 or possibly by 1988 if the number of lateral entrants is increased. OP-01 waged a successful lateral entrant recruitment program during 1985, netting nineteen lateral entrants, including four GURL's. Two of the GURL laterals held a 9036Q subspeciality code. There is currently a pool of 45 GURL's who have graduate education in either the MPTA or Manpower and Personnel Management(General) fields. These individuals do not hold a xx33P/Q code because their Master's degree was in another academic field (xx36), the Master's degree did not fully meet the Navy's criteria for a xx33P code, or the graduate education was at less than the Master's level. Table 13 provides the distribution of these 45 officers by rank and subspecialty code. The table also includes an explanation of the subspecialty codes. These officers can upgrade their present codes to a xx33P if the appropriate graduate course work is completed. This group of officers represents a very real source of additional MPTA subspecialists and specialists. A continuing recruitment effort could produce the extra lateral entrants needed to build the specialist inventory to thirty before the 1990's.

TABLE 13. POTENTIAL MPTA SUBSPECIALISTS BY RANK AND SUBSPECIALTY CODE.

	CDR	LCDR	LT	LTJG
xx33F		1		
xx33G		4	6	1
xx36Q	2	2		
xx36P		1	1	
xx36F	3	4		
xx36G	2	10	7	1
	7	22	14	2

Field

xx33: Manpower, Personnel, and Training Analysis
xx36: Manpower and Personnel Management (General)

Suffix

F: Master's degree not fully meeting Navy criteria or graduate education at less than Master's level--proven subspecialist
G: Master's degree not fully meeting Navy criteria or graduate education at less than Master's level--not proven subspecialist
P: Master's level of education--not proven subspecialist
Q: Master's level of education--proven subspecialist

V. THE STEADY STATE IMPACT OF THE MPTA SPECIALIST

One item of interest to subspecialty managers is how the addition of specialists will change the inventory and student input requirements of their subspecialty. Because specialists will fill only billets within their subspecialty, their availability and utilization should be very high. The only anticipated reduction to their availability and utilization will be due to junior and senior service college attendance.

The graduate education steady state quota model, developed by Marshall in 1975 [Ref. 10], was used to project the steady state inventory and student input requirements for the MPTA subspecialty. These requirements were projected for the MPTA subspecialty both with and without specialists.

A. GRADUATE EDUCATION STEADY STATE QUOTA MODEL

1. General Information

The graduate education steady state quota model is currently used by the office of the Chief of Naval Operations (OP-114) to project annual input and steady state inventory requirements for Navy graduate education programs. The model can be run on an IBM PC compatible

microcomputer using an interactive computer program written in the APL language. Information about the program can be found in the Graduate Education Steady State Quota Model Users Manual. [Ref.11: p.6-1]

2. Model Inputs

Subspecialty specific inputs to the model include billet requirements, current inventory, and number and grade of lateral entrants. Each of these inputs are subcategorized as unrestricted line, restricted line, and staff corps. Inputs are updated as necessary.

In addition to the subspecialty inputs, there are seven computational factors that are inputs to the model. They are:

1. ALPHA. Fraction of officers entering graduate education to meet a future billet requirement in rank i, who are still in the Navy and eligible to meet that requirement when it occurs.

2. BETA. Fraction of those available to serve a P-code tour in rank i who get to serve such a tour.

3. GAMMA. Fraction of those serving in a P-coded billet in rank i who serve a P-coded tour in rank i+1.

4. Tour Length (TL). Total time spent in all utilization tours in one grade. These times are obtained from the carrer patterns which show the expected timing and frequency of utilization tours.

5. Promotion Flow Point (PFP), i.e., years of service at promotion, also obtained from the career path.

6. Promotion Rate (PR). Historical rate of selection by selection boards.

7. Time in Grade (TIG). The time an officer spends in each grade, obtained from the career path. This factor assumes continuation of 100 percent for four years after school (because of obligated service), then normal continuation factors (for graduate educated officers, when available) thereafter for "due course" officers. [Ref. 11: pp.1-1, 1-2]

The current computional factors used by OP-114 for URL and staff corps officers are provided in Table 14. The restricted line was deleted because there are no 1610 or 1630 officers in the inventory to fill their six MPTA billets. Instead, the restricted line position in the model was filled by the GURL specialists to facilitate use of the model.

3. Assumptions made about the MPTA Specialist

Once a GURL officer is designated as a specialist, that officer's utilization and reutilization behavior within the subspecialty is expected to differ significantly from GURL and other URL officers who are not specialists. Therefore, many of the computational factors used in the student quota model for URL officers are inappropriate if applied to specialists.

The computational factors used in the model for promotion flow points, promotion rates, and time in grade for URL officers were used unchanged for specialists. The specialist will remain an URL officer and

TABLE 14. CURRENT GRADUATE EDUCATION STEADY STATE QUOTA MODEL FACTORS.

	URL				STAFF			
	CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG
ALPHA	.60	.70	.80	.95	.50	.70	.80	.95
BETA	.83	.74	.70	.70	.98	.98	.98	.90
GAMMA	.30	.59	.58		.37	.66	.88	
TL as:	CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT
	3.6	2.7	2.5	2.5	4.5	3.8	3.7	2.0
PFP	21	15	10	4	22	16	11	4
PR	.50	.70	.80	.95	.60	.75	.80	.95

TIMES IN GRADE (TIGS)

	Rank at graduation				Rank at graduation			
TIGS	CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG
LT			3.0	4.9			3.0	4.7
LCDR		4.0	4.8	3.5		4.0	4.4	3.65
CDR	4.0	2.7	1.9	1.9	4.0	3.4	2.4	2.0
CAPT	2.2	1.1	1.1	1.1	1.7	1.0	1.0	1.0

therefore be considered for promotion by the URL selection board. At this time there is no historical information that can be used to estimate the ALPHA, BETA, GAMMA, and tour length factors for the specialist. Therefore, it is necessary to make assumptions to estimate those factors.

In general, it was assumed that in the future, when GURL officers are sent to NPS, they will be considered as potential specialists and utilized immediately upon graduation. Therefore, ALPHA was set at 95% for all grades, thereby allowing for a 5% attrition rate from the program. This attrition rate was estimated in Chapter 2 from historical data. Since it was assumed that all officers would serve the utilization tour immediately, BETA was set at 100%.

GAMMA, the reutilization factor, was set at 95% for officers educated at the Lieutenant and Lieutenant Commander grade because it is expected that in these grades a high degree of reutilization will be achieved. GAMMA was set at 50% for officers educated as Commanders because such officers have probably met retirement criteria upon completion of their obligated service resulting from their attendance at NPS and therefore might not complete a second utilization tour.

The tour length factor identifies the average length of a utilization tour in a specific grade, or if more than one utilization tour is served in a grade, the sum of such tour lengths. The specialist, with few exceptions, will serve only in utilization tours and therefore tour length will be the sum of these tours in each grade. Total time in each grade was, therefore, thought to be the maximum possible tour length for a specialist. Total time in grade was used as an indicator of maximum tour length and should not be confused with the conditional times in grade (TIGS) factor explained at the end of the previous section. It is very unlikely that specialists will spend 100% of their time in grade in utilization tours. Some time will be lost during permanent change of station moves, attendance at service colleges which average 6-12 months, or attendance at NPS in the 18 month MPTA curriculum.

Tour lengths for the specialist were estimated by first determining the time spent in each grade and then subtracting any time not spent in utilization tours. Using the current promotion flow points of 9 years and 6 months, 15 years and 2 months, and 21 years for promotion to LCDR, CDR, and CAPT respectively, the total times in grade are 5 1/2 years for LT's and LCDR's and 6 years for CDR's. Time in grade as a

captain is extremely variable due to variability in the time of retirement and selection to flag rank. Because many losses occur at 26 years of service, five years was considered the average time in grade as a captain. One year was subtracted from the total time in grade for grades LCDR-CAPT to reflect time not spent in utilization tours. This produced tour lengths of 4.5, 5, and 4 years for LCDR-CAPT respectively. A minimum tour length of 3 years was used for LT's because a large number of GURL officers are educated at that level and therefore it was more realistic to expect them to complete only one utilization tour as a LT. Table 15 provides a summary of the computational factors used in the student quota model for MPTA specialists.

B. MODEL USE

The model was run four times using the model version called SSQUOTA2. This version allows the testing of alternative subspecialties. The model outputs are defined in Appendix E. The results of each model run can be found in Appendices F-I.

The 1 October 1985 subspecialist inventory was used for the first two runs. This inventory was selected because it should closely approximate the inventory that will exist at the time the first

TABLE 15. ESTIMATED GRADUATE EDUCATION STEADY STATE QUOTA MODEL FACTORS FOR THE MPTA SPECIALIST.

	CDR	LCDR	LT	LTJG
ALPHA	.95	.95	.95	.95
BETA	1.0	1.0	1.0	1.0
GAMMA	.50	.95	.95	

TL as:	CAPT	CDR	LCDR	LT
	4.0	5.0	4.5	3.0

PFP	21	15	10	4
PR	.50	.70	.80	.95

TIMES IN GRADE (TIGS)

	Rank at graduation			
TIGS	CDR	LCDR	LT	LTJG
LT			3.0	4.9
LCDR		4.0	4.8	3.5
CDR	4.0	2.7	1.9	1.9
CAPT	2.2	1.1	1.1	1.1

specialists are selected in March 1986. The first run (Appendix F) modelled the current system with no specialists. For the second run (Appendix G), twelve URL billets were designated as specialist billets and separated from the URL billet inventory. The model was run to build a steady state inventory of subspecialists and specialists (separately) to fill requirements in these twelve specialist billets. Fifteen GURL officers were "selected" as specialists, removed from the URL current inventory , and assigned to the specialist current inventory. The grade distribution of the specialists and of the specialist billets was chosen to resemble one that could realistically be supported by the 1 October 1985 GURL inventory. The same procedure was used for the third and fourth runs (Appendices H and I) except the 1 October 1987 inventory was used. For the fourth run, 25 billets were designated as specialists billets and 30 GURL officers were selected as specialists. The 1 October 1987 subspecialist inventory was chosen because it should closely approximate the inventory at the time of the March 1988 subspecialty selection board.

C. MODEL RESULTS

The results of the four runs are summarized in Table 16. The staff corps officers, Medical Service and Nurse Corps, have been excluded from

TABLE 16. SUMMARY OF STEADY STATE MODEL OUTPUTS.

RUN:	1	2	2	2	3	4	4	4
	ALL URL	URL	SP	TOTAL	ALL URL	URL	SP	TOTAL
BILLETS:	153	141	12	153	153	128	25	153
INVENTORY:	135	120	15	135	157	127	30	157
UQ:	51	47	2	49	51	44	3	47
SSI:	517	471	22	493	517	435	33	468
ICQ:	62	57	2	59	62	53	3	56

the summary because the specialist will have no impact on their quotas or steady state inventories. The information for the staff corps can be found in the appendices F-I.

When the model was run using the inventories of 1 October 1985 and 1 October 1987 and no specialists were included, the results were identical. This type of result can be expected with a steady state model because long range inventories and quotas are computed. In both runs, the current subspecialist inventory was far below the required steady state inventory and therefore the unconstrained and inventory constrained quotas were the same. If the two current inventories had been more dissimiliar, these two quotas would have been different.

When 15 GURL officers were designated as specialists, the steady state inventory requirement for URL officers dropped from 517 to 493, a difference of 24 officers. The unconstrained quota went from 51 to 49, while the inventory constrained quota went from 62 to 59.

When 30 GURL officers were designated as specialists, similiar changes occurred. The steady state inventory requirement changed from 517 to 468, a difference of 49 officers. The unconstrained quota went from 51 to 47 and the inventory constrained quota dropped from 62 to 56.

The separation of the specialist resulted in reduced inventory and quota requirements, even though no changes were made to the total URL inventory. A lower requirement for warfare qualified officers will mean fewer of these officers will need to attend NPS and eventually serve utilization tours. This will increase their availablity to serve operational tours, a benefit to fleet readiness. There should also be cost savings realized because fewer officers will attend NPS.

VI. FINDINGS AND CONCLUSIONS

*LATERAL ENTRANTS

During the years 1979 through 1984, only twelve officers were lateral entrants into the MPTA community. However in 1985, nineteen officers became lateral entrants. This jump can be attributed to an increased awareness of the MPTA subspecialty and the elimination of xx36 billets. Large influxes of lateral entrants are not expected to reoccur in subsequent years, leaving NPS to continue its role as the primary source of "recruits" into the MPTA subspecialty.

*ATTRITION FROM THE MPTA CURRICULUM

The attrition rate of those individuals who originally began their NPS studies in the MPTA curriculum was 8.6% using data from fiscal years 1980-85. Some of these losses were offset by transfers into the MPTA program, yielding an overall attrition rate of 5.6% for those years. The FY 1986-7 graduating classes have already experienced losses of 13.7% with the potential for additional losses prior to graduation.

***GURL AVAILABILITY AND UTILIZATION**

Though a greater percent of GURL (92%) than other URL (22%) officers were available for first tour utilization, their percent utilization (66%) was identical. Second tour information was known for ten GURL officers. Of these ten, four were available with two utilized and six were assigned to leadership billets. Such leadership assignments had a more significant impact on the availability of second tour GURL officers than originally anticipated.

***MEDICAL DEPARTMENT MPTA SUBSPECIALISTS**

The utilization of medical department MPTA subspecialists who graduated in 1979-83 has been very low. However, six of seven 1984-6 graduates have been assigned to utilization tours after graduation.

***PREDICTING XX33P/Q BILLET FILLS**

Three methods were used to predict the number of xx33P/Q billets that would be correctly filled by an inventory of xx33P/Q subspecialists. It was found that the number of filled billets could be estimated by multiplying the expected inventory by 19-26%, asssuming past trends continue.

The Markov model could also be used to predict billet fills. As can be found in Appendix A, it predicted that between 22-23% of all URL officers would be in utilization type billets during years 1982-85. In steady state this percentage drops to 20% for all URL officers. These results are very consistent with those achieved using other methods.

***FILLING DESIGNATOR SPECIFIC BILLETS**

The MPTA subspecialist inventory is expected to include approximately 178 officers by 1 October 1987, excluding any lateral entrants. Even though there will be an overall shortage of subspecialists to fill the 192 authorized xx33P/Q billets, there will be enough subspecialists with the designators 1110, 1120, 1130, and 1310 for those designator specific requirements. For example, it was estimated that there will be nine pilots for every MPTA billet that requires the additional qualification of a pilot.

***SHORTAGE OF GURL MPTA SUBSPECIALISTS**

While the addition of specialists to the MPTA subspeciality is expected to reduce inventory and student quota requirements, there is currently a paucity of GURL officers eligible to become specialists. Based on the current inventory and the average number of GURL officers

who graduate from NPS, it might not be possible to garner a cadre of 30 specialists until 1992.

***COMPARISION OF STEADY STATE RESULTS**

Assuming the availability and utilization of URL officers does not change, the graduate education steady state quota model predicts that a steady state inventory of 517 URL officers will be required to fill 153 xx33P/Q billets or 3.37 officers for every billet (see Appendix F).

Assuming current URL availability, utilization and recruitment, the Markov model predicts that there will be 170 officers in utilization type billets out of an inventory of 855 URL officers in steady state (see Appendix B). This equates to 765 officers to fill the currently authorized 153 billets or 5 officers for every billet. The Markov model steady state prediction is actually optimistic because it assumes very low attrition.

The graduate education steady state quota model produces overly optimistic results for the MPTA subspecialty when compared to the Markov model. It is impossible to tell whether the computational factors for the graduate education steady state quota model are invalid for the MPTA subspecialist or whether the current turbulence in the MPTA community prevents accurate predictions.

VII. RECOMMENDATIONS

Foremost, a job analysis should be conducted for all xx33P/Q billets to determine if valid requirements exist for officers with a Master's level degree. In addition, all xx33P/Q billets which require a specific officer primary specialty should be reviewed to determine if the primary specialty is essential for job performance or just 'nice to have'.

The concept of generic subspecialists should be explored. A generic subspecialist would be assigned to a xx33P/Q billet based on subspeciality skills and not primary officer specialty. This would allow the assignment of subspecialist resources based on the Navy's priorities for subspecialists.

It is recommended that the aviation community review its assignment of pilots to the MPTA curriculum. NFO's and 1300 officers should be able to fill most of the aviation specific billets and undoubtedly at a lower billet cost.

It is recommended that the Medical Department review its policies for assignment of Medical Service Corps and Nurse Corps officers to the

MPTA curriculum, in particular with regards to the cost and benefits of filling 2000 designator billets with such officers.

All GURL NPS graduates should be utilized immediately upon graduation. Any previous graduates who have not been served a utilization tour should be assigned to an xx33P/Q billet as soon as possible. These actions will increase the number of GURL officers who meet the specialist selection criteria.

It is recommended that GURL officers not be assigned to non xx33P/Q executive officer tours until given the opportunity to accept or decline the specialist track.

An effort should be made to increase the number of GURL MPTA subspecialists. This would be possible by increasing the NPS quota and/or actively recruiting xx36F/G/P/Q and xx33F/G officers for redesignation as a xx33P subspecialist. It may be feasible to develop an intensive NPS program for officers who already possess a Master's level degree that would enable them to 'upgrade' their subspeciality code. An increase of GURL subspecialists is needed if the Navy expects to have 30 MPTA specialists prior to 1992.

APPENDIX A. COMPUTER OUTPUT FROM VALIDATION OF MARKOV MODEL FOR MPTA WARFARE OFFICERS.

```
    )LOAD 9 OS4701A

    START

DO YOU WISH TO ENTER DATA?
    0 NO
    1 YES
&:    1

ENTER THE NUMBER OF THE MODEL TYPE
    1 MARKOV HIERARCHICAL
    2 MARKOV LENGTH OF SERVICE
    3 MARKOV GENERAL
    4 VACANCY
&:    3

ENTER N (INITIAL STOCK VECTOR)
&: 28 6 2

ENTER P (TRANSITION MATRIX) BY ROWS
ENTER 1TH ROW
&: .771 .078 .131

ENTER 2TH ROW
&: .333 .667 0

ENTER 3TH ROW
&: .156 .031 .781

ENTER THE NUMBER OF THE RECRUIT TYPE
    1 FIXED RECRUIT VECTOR
    2 ADDITIVE (RECRUIT SIZE)
    3 MULTIPLICATIVE (RECRUIT SIZE)
    4 MULTIPLICATIVE (SYSTEM SIZE)
&: 1
```

```
ENTER R (RECRUITMENT VECTOR)
&: 10 1.5 .75

ENTER THE PRECENT CODE
   0 NO GRADE PERCENTAGES
   1 GRADE SIZE AS PERCENT OF TOTAL GRADE SIZE
   2 GRADE SIZE AS PERCENT OF ORIGINAL GRADE SIZE
   7 QUIT PROGRAM
&: 1

WOULD YOU LIKE TO SEE THE ENTERED DATA?
   0 NO
   2 YES
&: 1

   P MATRIX
0.771  0.078  0.131      w1=.020
0.333  0.667  0          w2=0
0.156  0.031  0.781      w3=.032

   N VECTOR
28  6  2

OPTION =1
   R VECTOR
10  1.5  0.75

WOULD YOU LIKE TO CHANGE ANY OF THE DATA?
   0 NO
   1 YES
   7 QUIT PROGRAM
&:   0

ENTER THE NUMBER OF THE YEAR YOU WISH TO SEE
&: 4

DO YOU WISH TO SEE THE INTERVENING YEARS?
   0 NO
```

1 YES
&: 1

TIME	CTGRY	STOCKS	PERCENT	RECRUITS	*ACTUAL*	% ERROR
0	1	28	(78)			
	2	6	(17)			
1982	3	2	(6)			
	TOTAL	36	(100)			
1	1	34	(71)		36	5.6%
	2	8	(16)		5	60%
1983	3	6	(12)		5	20%
	TOTAL	48	(133)	12	46	4.3%
2	1	40	(67)		43	6.9%
	2	9	(16)		8	12.5%
1984	3	10	(17)		11	9.1%
	TOTAL	59	(164)	12	62	4.8%
3	1	45	(65)		46	2.2%
	2	11	(16)		14	21.4%
1985	3	14	(19)		14	0.0%
	TOTAL	70	(194)	12	74	5.4%
4	1	51	(63)		49	4.1%
	2	13	(16)		14	7.1%
1986	3	17	(21)		18	5.5%
	TOTAL	81	(225)	12	81	0.0%

DO YOU WISH TO SEE ANY OTHER YEARS?
0 NO
1 YES
7 QUIT PROGRAM
&: 0

```
DO YOU WISH TO SEE THE STEADY STATE VECTOR?
   0 NO
   1 YES
&: 1

   9999   1        310     (52)
          2         95     (16)
          3        189     (32)
          TOTAL    594     (100)      12
```

NOTE THAT UNDER CONDITIONS OF GROWTH ONLY THE PERCENTAGES ARE VALID

APPENDIX B. COMPUTER OUTPUT FROM VALIDATION OF MARKOV MODEL FOR MPTA ALL URL OFFICERS.

```
    )LOAD 9 OS4701A

    START

DO YOU WISH TO ENTER DATA?
    0 NO
    1 YES
 &:   1

ENTER THE NUMBER OF THE MODEL TYPE
    1 MARKOV HIERARCHICAL
    2 MARKOV LENGTH OF SERVICE
    3 MARKOV GENERAL
    4 VACANCY
&:   3

ENTER N (INITIAL STOCK VECTOR)
&: 28 9 4

ENTER P (TRANSITION MATRIX) BY ROWS
ENTER 1TH ROW
&: .77 .091 .121

ENTER 2TH ROW
&: .268 .643 .071

ENTER 3TH ROW
&: .14 .07 .767

ENTER THE NUMBER OF THE RECRUIT TYPE
    1 FIXED RECRUIT VECTOR
    2 ADDITIVE (RECRUIT SIZE)
    3 MULTIPLICATIVE (RECRUIT SIZE)
    4 MULTIPLICATIVE (SYSTEM SIZE)
&: 1
```

```
ENTER R (RECRUITMENT VECTOR)
&: 10 .5 4.25 2

ENTER THE PRECENT CODE
   0 NO GRADE PERCENTAGES
   1 GRADE SIZE AS PERCENT OF TOTAL GRADE SIZE
   2 GRADE SIZE AS PERCENT OF ORIGINAL GRADE SIZE
   7 QUIT PROGRAM
&: 1

WOULD YOU LIKE TO SEE THE ENTERED DATA?
   0 NO
   2 YES
&: 1

   P MATRIX
0.77   0.091  0.121      w1=.018
0.268  0.643  0.071      w2=.018
0.14   0.07   0.767      w3=.023

   N VECTOR
28 9 4

OPTION =1
   R VECTOR
10.5 4.25 2

WOULD YOU LIKE TO CHANGE ANY OF THE DATA?
   0 NO
   1 YES
   7 QUIT PROGRAM
&:   0

ENTER THE NUMBER OF THE YEAR YOU WISH TO SEE
&: 4

DO YOU WISH TO SEE THE INTERVENING YEARS?
   0 NO
```

1 YES

&: 1

TIME	CTGRY	STOCKS	PERCENT	RECRUITS	*ACTUAL*	%ERROR
0	1	28	(68)			
	2	9	(22)			
1982	3	4	(10)			
	TOTAL	41	(100)			
1	1	35	(61)		38	7.9%
	2	13	(23)		9	44.4%
1983	3	9	(16)		6	50.0%
	TOTAL	57	(139)	17	53	7.5%
2	1	42	(58)		47	10.6%
	2	16	(22)		15	6.7%
1984	3	14	(19)		14	0.0%
	TOTAL	73	(178)	17	76	3.9%
3	1	49	(56)		52	5.7%
	2	20	(22)		23	13.0%
1985	3	19	(22)		19	0.0%
	TOTAL	88	(215)	17	94	6.4%
4	1	56	(55)		53	5.7%
	2	23	(22)		24	4.2%
1986	3	24	(23)		26	7.7%
	TOTAL	103	(251)	17	103	0.0%

DO YOU WISH TO SEE ANY OTHER YEARS?

0 NO

1 YES

7 QUIT PROGRAM

&: 0

```
DO YOU WISH TO SEE THE STEADY STATE VECTOR?
   0 NO
   1 YES
&: 1

   9999   1        411     (48)
          2        170     (20)
          3        274     (32)
          TOTAL    855     (100)      17
-----------------------------------------------------------------
```

NOTE THAT UNDER CONDITIONS OF GROWTH ONLY THE PERCENTAGES ARE VALID

APPENDIX C. COMPUTER OUTPUT FROM FORECAST WITH MARKOV MODEL FOR MPTA WARFARE OFFICERS.

```
    )LOAD 9 OS4701A

    START

DO YOU WISH TO ENTER DATA?
    0 NO
    1 YES
 &:   1

ENTER THE NUMBER OF THE MODEL TYPE
    1 MARKOV HIERARCHICAL
    2 MARKOV LENGTH OF SERVICE
    3 MARKOV GENERAL
    4 VACANCY
&:   3

ENTER N (INITIAL STOCK VECTOR)
&: 49 14 18

ENTER P (TRANSITION MATRIX) BY ROWS
ENTER 1TH ROW
&: .739 .087 .152

ENTER 2TH ROW
&: .357 .643 0

ENTER 3TH ROW
&: .143 0 .786

ENTER THE NUMBER OF THE RECRUIT TYPE
    1 FIXED RECRUIT VECTOR
    2 ADDITIVE (RECRUIT SIZE)
    3 MULTIPLICATIVE (RECRUIT SIZE)
    4 MULTIPLICATIVE (SYSTEM SIZE)
&: 1
```

```
ENTER R (RECRUITMENT VECTOR)
&: 10 1.5 .75

ENTER THE PRECENT CODE
   0 NO GRADE PERCENTAGES
   1 GRADE SIZE AS PERCENT OF TOTAL GRADE SIZE
   2 GRADE SIZE AS PERCENT OF ORIGINAL GRADE SIZE
   7 QUIT PROGRAM
&: 1

WOULD YOU LIKE TO SEE THE ENTERED DATA?
   0 NO
   1 YES
&: 1

   P MATRIX
0.739 0.087 0.152   w1=0.022
0.357 0.643 0       w2=0
0.143 0     0.786   w3=0.071

   N VECTOR
49 14 18

OPTION =1
   R VECTOR
10 1.5 0.75

WOULD YOU LIKE TO CHANGE ANY OF THE DATA?
   0 NO
   1 YES
   7 QUIT PROGRAM
&:   0

ENTER THE NUMBER OF THE YEAR YOU WISH TO SEE
&: 3

DO YOU WISH TO SEE THE INTERVENING YEARS?
   0 NO
```

1 YES
&: 1

TIME	CTGRY	STOCKS	PERCENT	RECRUITS
0	1	49	(60)	
	2	14	(17)	
1986	3	18	(22)	
	TOTAL	81	(100)	
1	1	54	(59)	
	2	15	(16)	
1987	3	22	(25)	
	TOTAL	91	(112)	12
2	1	58	(58)	
	2	16	(16)	
1988	3	26	(26)	
	TOTAL	100	(123)	12
3	1	62	(57)	
	2	17	(15)	
1989	3	30	(28)	
	TOTAL	109	(135)	12

DO YOU WISH TO SEE ANY OTHER YEARS?
0 NO
1 YES
7 QUIT PROGRAM
&: 0

DO YOU WISH TO SEE THE STEADY STATE VECTOR?
0 NO
1 YES
&: 1

9999	1	166	(50)
	2	45	(13)
	3	121	(37)
	TOTAL	332	(100)

NOTE THAT UNDER CONDITIONS OF GROWTH ONLY THE PERCENTAGES ARE VALID

APPENDIX D. COMPUTER OUTPUT FROM FORECAST WITH MARKOV MODEL FOR MPTA ALL URL OFFICERS.

```
    )LOAD 9 OS4701A

    START

DO YOU WISH TO ENTER DATA?
    0 NO
    1 YES
 &:   1

ENTER THE NUMBER OF THE MODEL TYPE
    1 MARKOV HIERARCHICAL
    2 MARKOV LENGTH OF SERVICE
    3 MARKOV GENERAL
    4 VACANCY
&:   3

ENTER N (INITIAL STOCK VECTOR)
&: 53 24 26

ENTER P (TRANSITION MATRIX) BY ROWS
ENTER 1TH ROW
&: .712 .135 .135

ENTER 2TH ROW
&: .261 .565 .13

ENTER 3TH ROW
&: .105 .053 .789

ENTER THE NUMBER OF THE RECRUIT TYPE
    1 FIXED RECRUIT VECTOR
    2 ADDITIVE (RECRUIT SIZE)
    3 MULTIPLICATIVE (RECRUIT SIZE)
    4 MULTIPLICATIVE (SYSTEM SIZE)
&: 1
```

```
ENTER R (RECRUITMENT VECTOR)
&: 10.5 4.25 2

ENTER THE PRECENT CODE
   0 NO GRADE PERCENTAGES
   1 GRADE SIZE AS PERCENT OF TOTAL GRADE SIZE
   2 GRADE SIZE AS PERCENT OF ORIGINAL GRADE SIZE
   7 QUIT PROGRAM
&: 1

WOULD YOU LIKE TO SEE THE ENTERED DATA?
   0 NO
   2 YES
&: 1

   P MATRIX
0.712 0.135 0.135   w1=0.019
0.261 0.565 0.13    w2=0.043
0.105 0.053 0.789   w3=0.052

   N VECTOR
53 24 26

OPTION =1
   R VECTOR
10.5 4.25 2

WOULD YOU LIKE TO CHANGE ANY OF THE DATA?
   0 NO
   1 YES
   7 QUIT PROGRAM
&:   0

ENTER THE NUMBER OF THE YEAR YOU WISH TO SEE
&: 3

DO YOU WISH TO SEE THE INTERVENING YEARS?
```

0 NO
1 YES
&: 1

TIME	CTGRY	STOCKS	PERCENT	RECRUITS
0	1	53	(51)	
	2	24	(23)	
1986	3	26	(25)	
	TOTAL	103	(100)	
1	1	57	(49)	
	2	26	(23)	
1987	3	33	(28)	
	TOTAL	116	(113)	17
2	1	62	(48)	
	2	29	(22)	
1988	3	39	(32)	
	TOTAL	129	(125)	17
3	1	66	(46)	
	2	31	(22)	
1989	3	45	(32)	
	TOTAL	142	(138)	17

DO YOU WISH TO SEE ANY OTHER YEARS?
0 NO
1 YES
7 QUIT PROGRAM
&: 0

DO YOU WISH TO SEE THE STEADY STATE VECTOR?
0 NO
1 YES
&: 1

9999	1	182	(40)	
	2	88	(20)	
	3	181	(40)	
	TOTAL	451	(100)	170

NOTE THAT UNDER CONDITIONS OF GROWTH ONLY THE PERCENTAGES ARE VALID

APPENDIX E. DEFINITIONS OF STEADY STATE MODEL OUTPUTS.

Subspecialty Billets: The authorized xx33P/Q billets or those hypothetical billets used for experimental modelling.

Subspecialty Inventory: The inventory entered in the model, whether current or hypothetical.

Unconstrained Quota(UQ): The annual student input necessary to maintain the required steady state inventory of MPTA subspecialists.

Steady State Inventory(SSI): The inventory required to fill all xx33P/Q coded billets.

Inventory-Constrained Quota(ICQ): The annual student input necessary to maintain the required steady state inventory of MPTA subspecialists as corrected for inventory surpluses or shortages. For example, if the current inventory is below the required steady state inventory, the inventory-constrained quota will be greater than the unconstrained quota to compensate for these shortages.

APPENDIX F. MODEL OUTPUT USING INVENTORY ON 1 OCTOBER 1985, NO SPECIALISTS.

URL				SPECIALISTS				STAFF				
SUBSPECIALTY BILLETS												
CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	TOTAL
21	63	53	16					3	11	15	4	186
SUBSPECIALTY INVENTORY												
CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	TOTAL
9	35	71	20						2	6	3	146
UNCONSTRAINED QUOTA												
CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG	TOTAL
	13	28	10							3	2	56
STEADY STATE INVENTORY												
CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	TOTAL
56	107	221	133					5	11	21	18	572
INVENTORY-CONSTRAINED QUOTA												
CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG	TOTAL
	16	34	12							4	2	68

APPENDIX G. MODEL OUTPUT USING INVENTORY ON 1 OCTOBER 1985, 15 SPECIALISTS.

URL				SPECIALISTS				STAFF				
SUBSPECIALTY BILLETS												
CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	TOTAL
21	59	47	14		4	6	2	3	11	15	4	186
SUBSPECIALTY INVENTORY												
CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	TOTAL
9	31	64	16		4	7	4		2	6	3	146
UNCONSTRAINED QUOTA												
CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG	TOTAL
	14	25	8			1	1			3	2	54
STEADY STATE INVENTORY												
CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	TOTAL
52	101	204	114	2	4	8	8	5	11	21	18	548
INVENTORY-CONSTRAINED QUOTA												
CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG	TOTAL
	17	30	10			1	1			4	2	65

APPENDIX H. MODEL OUTPUT USING INVENTORY ON 1 OCTOBER 1987, NO SPECIALISTS.

URL				SPECIALISTS				STAFF				
SUBSPECIALTY BILLETS												
CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	TOTAL
21	63	53	16					3	11	15	4	186
SUBSPECIALTY INVENTORY												
CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	TOTAL
12	53	75	17						4	12	3	176
UNCONSTRAINED QUOTA												
CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG	TOTAL
	13	28	10							3	2	56
STEADY STATE INVENTORY												
CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	TOTAL
56	107	221	133					5	11	21	18	572
INVENTORY-CONSTRAINED QUOTA												
CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG	TOTAL
	16	34	12							4	2	68

APPENDIX I. MODEL OUTPUT USING INVENTORY ON 1 OCTOBER 1987, 30 SPECIALISTS.

URL	SPECIALISTS	STAFF

SUBSPECIALTY BILLETS

CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	TOTAL
18	55	41	14	3	8	12	2	3	11	15	4	186

SUBSPECIALTY INVENTORY

CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	TOTAL
12	45	59	11		8	16	6		4	12	3	176

UNCONSTRAINED QUOTA

CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG	TOTAL
	15	21	8			2	1			3	2	52

STEADY STATE INVENTORY

CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	CAPT	CDR	LCDR	LT	TOTAL
48	96	189	102	3	6	13	11	5	11	21	18	523

INVENTORY-CONSTRAINED QUOTA

CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG	CDR	LCDR	LT	LTJG	TOTAL
	18	25	10			2	1			4	2	62

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